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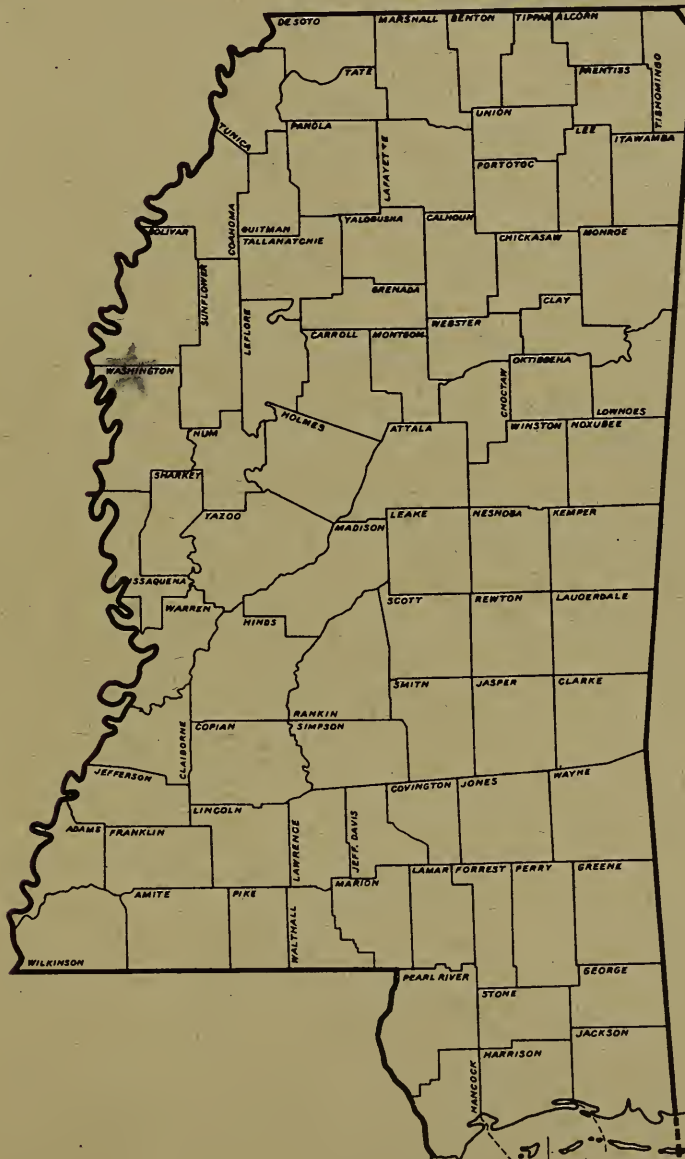
WATERSHED WORK PLAN

FOR

WATERSHED PROTECTION, FLOOD PREVENTION,
AGRICULTURAL WATER MANAGEMENT AND
OTHER BENEFICIAL PURPOSES

DEER CREEK WATERSHED

BOLIVAR AND WASHINGTON COUNTIES, MISSISSIPPI



DECEMBER 1975

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ADDENDUM

December 1975

WATERSHED WORK PLAN

Deer Creek Watershed

Bolivar and Washington Counties
Mississippi



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INTRODUCTION

This addendum is based on the Water Resources Council's Principles and Standards for Planning.

The Deer Creek Watershed Work Plan is developed using current (1975) construction costs and $6 \frac{1}{8}$ percent discount rates. Current ($6 \frac{1}{8}\%$) discount rate comparison is displayed.

Effects resulting from evaluation of the selected work plan alternative are displayed under separate accounts for National Economic Development, Environmental Quality, Regional Development and Social Well-Being.

The abbreviated environmental quality plan has been developed by an interdisciplinary team using information and data assembled during investigations and analysis for the watershed work plan. This procedure begins with recognition of the watershed problems and needs. Desired environmental effects or component needs are translated from the problems and needs and provide a base of examining appropriate water and land resource use and management opportunities. Opportunities that emphasize contributions to the component needs were selected and are shown as plan elements of the alternative. The cost of \$1,299,500 for its installation is a preliminary estimate. The expected environmental effects of the alternative are shown.

Implementation of features of this alternative will require acceptance by the local people. Adequate legislative authorities exist for implementation; however, funding is presently not available.

DISCOUNT RATE COMPARISON

Deer Creek Watershed, Mississippi

This display shows the result of using the current discount rate (6 1/8%) in the economic evaluation. Annual project cost, benefits, and benefit-cost ratio for the current discount rate are as follows:

1. Annual project costs	\$171,400
2. Annual project benefits (including external economics)	\$401,300
3. Benefit-cost ratio (including external economics)	2.3:1.0
4. Annual project benefits (excluding external economics)	\$357,000
5. Benefit-cost ratio (excluding external economics)	2.1:1.0

SELECTED ALTERNATIVE
 NATIONAL ECONOMIC DEVELOPMENT ACCOUNT
 Deer Creek Watershed, Mississippi

Measures of Effects 1/
 - - - Dollars - - -

Components

Measures of Effects 1/
 - - - Dollars - - -

Beneficial effects:

A. The value to users of increased outputs of goods and services.

- 1. Flood prevention 233,100
- 2. Drainage 101,300
- 3. Rural Area Development 22,600

Total beneficial effects 357,000

1
3
1

Adverse effects:

- 1. Structural measures - channel work
- Project installation
- Project Administration
- OM&R

141,100
 17,700
12,600

Total adverse effects 171,400

Net beneficial effects 185,600

1/ Average annual

SELECTED ALTERNATIVE
ENVIRONMENTAL QUALITY ACCOUNT
Deer Creek Watershed, Mississippi

<u>Components</u>	<u>Measures of Effects</u>	<u>Components</u>	<u>Measures of Effects</u>
A. Areas of Natural Beauty	<ol style="list-style-type: none"> 1. Eroded areas will be reduced. 2. Stream channel banks will be altered. 3. Gross erosion rates will be reduced, thus reducing the opportunities for sediment to enter streams and lakes. 	C. Biological resources and selected ecosystems.	<ol style="list-style-type: none"> 1. Improved cover conditions, wildlife food plantings, and wildlife habitat preservation will enhance wildlife production. 2. Existing fishery resources will be altered on approximately 50 miles of stream channels. 3. Improved soil-water relationship will result in increased populations of beneficial and non-beneficial organisms and micro-organisms. 4. Reduction of excess water on agricultural lands will result in growth of higher quality plant systems
B. Quality consideration of water, air, and land resources.	<ol style="list-style-type: none"> 1. There will be temporary degradation of water quality during construction. 2. There will be air pollution and noise level increase during the construction period. 3. Downstream sediment delivery will be reduced. 4. Physical properties and fertility of the soils will be improved. 		

(continued)

SELECTED ALTERNATIVES
 ENVIRONMENTAL QUALITY ACCOUNT (continued)
 Deer Creek Watershed, Mississippi

<u>Components</u>	<u>Measures of Effects</u>	<u>Components</u>	<u>Measures of Effects</u>
C. (continued)	5. Approximately 89 acres of wetlands (type 7) will become subject to drainage. This area will be mitigated by the installation of 50 wood duck nesting boxes in Saw Grass Lake.	E. Irreversible or irretrievable commitment.	1. Approximately 341 acres of woodland and 479 acres of open land will be committed to stream channels.
D. Historical, ecological, and geological	1. The project measures will avoid disturbances of known archeological and historical values as listed in a study report by the Mississippi Department of Archives and History.		2. Capital, labor, materials, and energy required to install the project.

SELECTED ALTERNATIVE
REGIONAL DEVELOPMENT ACCOUNT
Deer Creek Watershed, Mississippi

	<u>Components</u>	<u>Measures of Effects</u> ^{1/}	<u>Measures of Effects</u> ^{1/}
		State of Mississippi	State of Mississippi
		Dollars	Dollars
Income:			
Beneficial effects:			
A. The value of increased output of goods and services to users residing in the region.			
1. Flood prevention		233,100	
2. Drainage		101,300	
3. Rural Area Development		22,600	
B. The values of output to users residing in the region from external economics.			
1. Induced by and stemming from effects		44,300	109,500
Total beneficial effects		401,300	109,500
^{1/} Annual values			
Adverse effects:			
A. The value of resources contributed from within the region to achieve the outputs.			
1. Structural measures - channel work			92,800
Project installation			16,700
Project administration			0
OM&R			0
Total adverse effects		61,900	109,500
Net beneficial effects		339,400	-109,500

(continued)

SELECTED ALTERNATIVE
REGIONAL DEVELOPMENT ACCOUNT (continued)
Deer Creek Watershed, Mississippi

<u>Components</u>	<u>Measures of Effects</u> State of Mississippi	<u>Rest of Nation</u>	<u>Components</u>	<u>Measures of Effects</u> State of Mississippi	<u>Rest of Nation</u>
Employment:			Employment:		
Beneficial effects:			Adverse effects:		
A. Increase in number and types of jobs.			A. Decrease in number and types of jobs.	0	0
1. Employment for project construction.	5.4 semi-skilled jobs per year.	--	Total adverse effects	0	0
2. Employment for project OM&R.	0.3 semi-skilled jobs per year for 50 years.		Net beneficial effects		
3. Employment in service and trade activities induced by and stemming from project operation.	127.0 permanent semi-skilled jobs.				
Total beneficial effects					
	5.4 semi-skilled jobs per year during the construction period.				
	0.3 semi-skilled jobs each year for 50 years.				
	127.0 permanent semi-skilled jobs.				

5.4 semi-skilled jobs per year during construction period.
0.3 semi-skilled jobs each year for 50 years.
127.0 permanent semi-skill jobs.

SELECTED ALTERNATIVE
REGIONAL DEVELOPMENT ACCOUNT (continued)
Deer Creek Watershed, Mississippi

Components

<u>Measures of Effects</u>	
<u>State of</u>	<u>Rest of</u>
<u>Mississippi</u>	<u>Nation</u>

Beneficial effects:

The level of protection is sufficient to maintain a sustained agricultural program on approximately 20,000 acres of watershed lands. A total of a out 11.1 million dollars of property will receive reduced flood damages. The project will create 5.1 semi-skilled jobs per year during the construction period, 0.3 semi-skilled jobs per year for 50 years, and 127.0 permanent semi-skilled jobs, in an area that is economically depressed.

Watershed protection and flood protection is an integral part of the success of many programs which are under way for the economic development and improvement of the watershed.

Adverse effects:

SELECTED ALTERNATIVE
SOCIAL WELL-BEING ACCOUNT
Deer Creek Watershed, Mississippi

Components

Beneficial and adverse effects:

A. Real Income Distribution

Measures of Effects

1. Create 127.3 man-years of semi-skilled employment.
2. Create regional ^{1/} income benefit distribution of \$357,000 flood prevention, drainage, and Rural Area Development benefits by income class as follows:

<u>Income Class</u>	<u>Percentage Adjusted Gross Income in Class</u>	<u>Percentage Benefits in Class</u>
Dollars		
Less than 2500	6	10
2500 - 10,000	18	20
More than 10,000	76	70

3. Local cost to be borne by region total with distribution by income class as follows:

<u>Income Class</u>	<u>Percentage of Adjusted Gross Income in Class</u>	<u>Percentage Contributors in Class</u>
Dollars		
Less than 2500	6	6
2500 - 10,000	18	18
More than 10,000	76	76

^{1/} The realization of the benefits is considered to occur in the watershed. Secondary benefits (\$44,300) will occur outside the watershed.

SELECTED ALTERNATIVE
SOCIAL WELL-BEING ACCOUNT (continued)
Deer Creek Watershed, Mississippi

Components

Beneficial and adverse effects:

B. Life, health, and safety

Measures of Effects

Provides a sufficient level of protection to roads and bridges so that travel of public roads and highways will not be interrupted or that vehicles will not have to travel through water. Provide flood and increased drainage that will reduce agricultural production costs, increase yields, and reduce vector habitat.

ENVIRONMENTAL QUALITY ALTERNATIVE

Deer Creek Watershed, Mississippi

The Deer Creek Watershed contains 43,872 acres of land (68.55 square miles) and is located in southeastern Bolivar County and northwestern Washington County in northwestern Mississippi.

Communities in or adjacent to the watershed include Eutaw, Benoit, Bolivar, Grapeland, Hannah, Lake Vista, Lamont, Scott, Stringtown, Priscilla, and Winterville. The population of the watershed is estimated to be 2,100 people. All of these are classed as rural population.

The current land use of the watershed is about 79 percent cropland, 3 percent grassland, 12 percent forest land, and 6 percent other land.

The streams in the watershed are not perennial, therefore leave pools of stagnant water in stream beds. This along with the lack of adequate sewage disposal facilities results in water quality problems in the watershed streams.

Recreation facilities in the watershed are limited in variety and extent.

Pollution of the atmosphere and surface water supplies by agricultural chemicals are a reality in the watershed. These provide hazards to inhabitants of the area. Drift of aerial applications of insecticides and the dumping of insecticide containers provide a ready source of contaminant materials. Fish samples in the general area of the watershed contain high levels of insecticides in their body tissues.

Fisheries resources in the watershed are poor. This is mainly due to the type streams present (intermittent and ephemeral), the clogged condition of the streams, the poor water quality, and the relative shallowness of the water in the lakes, ponds, and streams of the watershed.

Wind erosion becomes a problem during certain portions of each year when the agricultural lands are being prepared for planting and shortly thereafter. Strong northerly winds sweep across the flat open countryside and lift portions of loose, dry soils into air suspension.

Component Needs of the Plan

1. Water Storage for Maintaining Perennial Stream Flow in Portions of Deer Creek.

Stream flow at an adequate rate would provide water for sustaining a stream fisheries resource and for improving the quality of water. This could be accomplished in part by raising the level of Lake Bolivar during periods of intensive rainfall with the subsequent release of the

water during dry periods at a rate sufficient to supply perennial flow in the parts of Deer Creek that are lower in elevation than the lake.

Initial cost of water storage	-	\$126,000
Annual operation and maintenance costs	-	\$ 15,000

2. Facilities for Swimming, Picnicking, Hiking, and Boating.

The construction of a swimming pool, picnic tables, a boat dock and hiking trails will provide opportunities for recreation.

Cost of construction of basic recreation facilities including swimming pool, picnic units, group shelter, comfort station, water fountain, hiking trail, access road and parking	-	\$130,000
Annual operation and maintenance	-	\$ 10,000

3. Pollution of the Atmosphere and Surface Water Supplies.

This results largely from drift of aerial applications of agricultural chemicals, from the dumping of chemical containers and from the chemicals that are removed from the soils both in solution and in suspension in runoff waters from agricultural lands. Solutions to this problem include care in aerial application of chemical materials, use of materials less affected by wind drift, and the development of sediment ponds or traps at the confluence of field drainage ditches with the lakes and streams of the watershed. Additionally, the pick-up and decontamination or disposal of chemical containers would be a necessary part of the solution to the pollution problem.

Initial cost of construction of sediment ponds and decontamination station for agricultural chemical residues	-	\$450,000
Annual operation and maintenance costs	-	\$ 15,000

4. The Improvement of Stream and Lake Fisheries Resources

This will be accomplished by a combination of means including the raising of the water level of Lake Bolivar, the provision of water for perennial stream flow to portions of Deer Creek, and the reduction of input of agricultural chemicals and sediment by use of sediment ponds or traps.

Cost of raising the level of Lake Bolivar	-	\$126,000
Cost of sediment ponds	-	\$437,500
Annual operation and maintenance costs	-	\$ 20,000

5. Windbreaks to Reduce Wind Erosion, Air Pollution, and to Provide Additional Wildlife Habitat.

The planting of fast growing hardwoods and conifers as shelterbelts and windbreaks will reduce wind erosion, wind drift and thereby air pollution, and will provide additional wildlife habitat to the watershed. Windbreak areas will eventually result in sources of wood products useable locally and in the national economy.

Initial cost of trees and planting	-	\$ 30,000
Maintenance costs(annual) <u>1/</u>	-	\$ 5,000

1/ Annual maintenance costs consist of cultivation during the first three years of establishment.

Effects of the Environmental Quality Plan

1. The storage of water and its subsequent release for maintaining a continuous flow of water in Deer Creek would provide opportunities for both lake and stream fisheries resources and fishing. It would inundate some lowlying agricultural and forested areas in the upper reaches of Lake Bolivar.
2. The installation of facilities for swimming, picnicking, hiking, and boating would greatly increase recreation opportunities in the watershed area.
3. Reduction in the pollution of the air and of surface water supplies would increase the quality of living for both humans and wildlife in the watershed. The waters of the lakes and streams would contain less chemical residues and sediment. Fisheries resources would be improved and affected species would increase in population. Chemical containers and their detrimental effects would be removed from the scene. Additionally, sediment ponds might find secondary uses as irrigation ponds.
4. The effect of improved lake and stream fisheries resources in the watershed would result in greater human enjoyment of this recreational aspect.
5. Windbreaks would affect the watershed area by reducing wind erosion, wind drift, air pollution, and would provide shelter and living areas for both wild animals and birds. These areas, with proper management, would result in wood products useable both locally and in the national economy.

WATERSHED WORK PLAN AGREEMENT

between the

Deer Creek Water Management District
Bolivar County Soil and Water Conservation District
Washington County Soil and Water Conservation District

(hereinafter referred to as Sponsoring Local Organization)

STATE OF MISSISSIPPI

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Deer Creek Watershed, State of Mississippi, under the authority of the Watershed Protection and Flood Prevention Act (P.L. 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Deer Creek Watershed, State of Mississippi, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about three years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organization will acquire, with other than PL-566 funds, such land rights as will be needed in connection with works of improvement. (Estimated cost \$508,300.)

The Sponsoring Local Organization agrees that all land acquired or improved with PL-566 financial or credit assistance will not be sold or otherwise disposed of for the evaluated life of the project except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement.

2. The Sponsoring Local Organization assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsoring Local Organization and the Service as follows:

	<u>Sponsoring Local Organization</u> (Percent)	<u>Service</u> (Percent)	<u>Estimated Relocation Payment Costs</u> ^{1/} (Dollars)
Relocation Payments	45.08	54.92	0

3. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.
4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (Percent)	<u>Service</u> (Percent)	<u>Estimated Construction Cost</u> (Dollars)
50.1 Miles of Channel Work	15.72	84.28	1,524,300

^{1/} Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

5. The percentages of the engineering costs for services to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (Percent)	<u>Service</u> (Percent)	<u>Estimated Engineering Costs</u> (Dollars)
50.1 miles of Channel Work	0	100	152,600

6. The Sponsoring Local Organization and the Service will each bear their costs for project administration, estimated at \$15,200 and \$259,100, respectively.
7. The Sponsoring Local Organization will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.
8. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.
9. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
10. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the availability of appropriations for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties. An amendment to incorporate changes affecting one specific structural measure may be made by mutual agreement between the Service and the sponsor(s) having specific responsibilities for the particular structural measure involved.
14. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.
16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Deer Creek Water Management District
Local Organization

By _____

Title _____

Address _____ Zip Code _____

Date _____

The signing of this agreement was authorized by a resolution of the governing body of the Deer Creek Water Management District adopted at a meeting held on _____.

Secretary, Local Organization

Address _____ Zip Code _____

Date _____

Bolivar County Soil and Water Conservation District
Local Organization

By _____

Title _____

Address _____ Zip Code _____

Date _____

The signing of this agreement was authorized by a resolution of the governing body of the Bolivar County Soil and Water Conservation District adopted at a meeting held on _____.

Secretary, Local Organization

Address _____ Zip Code _____

Date _____

Washington County Soil and Water Conservation District
Local Organization

By _____

Title _____

Address _____ Zip Code _____

Date _____

The signing of this agreement was authorized by a resolution of the governing body of the Washington County Soil and Water Conservation District adopted at a meeting held on _____.

Secretary, Local Organization

Address _____ Zip Code _____

Date _____

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

State Conservationist

Date

WATERSHED WORK PLAN
DEER CREEK WATERSHED

Bolivar and Washington Counties
Mississippi

Prepared under the Authority of the Watershed
Protection and Flood Prevention Act (Public Law
566, 83rd Congress; 68 Stat. 666) as amended

Prepared by

Deer Creek Water Management District
Bolivar County Soil and Water Conservation District
Washington County Soil and Water Conservation District

With Assistance by:

U. S. Department of Agriculture, Soil Conservation Service
U. S. Department of Agriculture, Forest Service

December 1975

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WATERSHED WORK PLAN
DEER CREEK WATERSHED

Bolivar and Washington Counties, Mississippi

December 1975

SUMMARY OF PLAN

The Deer Creek Watershed is sponsored by the Deer Creek Water Management District and the Soil and Water Conservation Districts of Bolivar and Washington Counties.

The watershed contains 43,872 acres and comprises 40,630 acres in the southwestern part of Bolivar County and 3,242 acres in the northwestern part of Washington County.

Existing problems are: (1) Relatively low farm income which affects the economy of the people of the watershed, (2) Floodwater damages to crops, pastures, and fixed improvements, (3) Inadequate drainage of cropland and pastureland, (4) Moderate sheet erosion and deposition of sediment in downstream areas, and (5) Difficulty in establishing and maintaining open channels to remove floodwater and drainage waters.

These problems will be reduced to such an extent as is physically possible and economically feasible by establishing land treatment measures and constructing and/or improving approximately 50.1 miles of stream channels and other measures necessary to solve the watershed problems.

The application of the proposed works of improvement will accomplish the following: (1) Increase the income of low income farm families and small landowners, (2) Adequately drain cropland and pastureland for sustained agricultural use, (3) Provide adequate outlets and channels to remove floodwater and drainage water from agricultural areas of the watershed, (4) Reduce cost per unit of production and increase price per unit resulting from improved quality, and (5) Reduce sheet erosion on upland areas and sediment deposition in stream channels.

Approximately 121 farms and residences, small businesses, and utilities located within the watershed will be benefited by the project.

Of the 43,872 acres within the watershed, all will receive flood reduction and/or improved drainage benefits.

Land treatment measures will be installed, operated and maintained on private lands through conservation farm plans in cooperation with the respective Soil Conservation District. Land treatment measures will be installed, operated and maintained on public lands by the land administering agency in charge of these lands or by the individual farmer or operator

having leases on these lands. The land treatment measures will be installed at an estimated total cost of \$697,600.

Multiple-purpose channels for flood prevention and drainage will be installed by contract by the Soil Conservation Service at an estimated total cost of \$2,185,200.

The planned channel work consists of 50.1 miles of multiple purpose channels and includes 13.66 miles of channel clearing and shaping (type-class III), and approximately 36.49 miles of channel enlargement (type-class II). Stream channels include both natural and man-made channels. Existing streams are intermittent and/or ephemeral.

The multiple-purpose channels will be operated and maintained by the Deer Creek Water Management District at an estimated annual cost of \$12,600.

The planned works of improvement will be installed over a three-year installation period at an estimated cost of \$3,157,100.

The average annual costs of structural measures are estimated to be \$171,400. The average annual benefits are estimated to be \$401,300. The benefit-cost ratio is 2.3 to 1.0.

The Deer Creek Water Management District is a legal sub-division of the State of Mississippi and has legal authority as provided in Mississippi Senate Bill 1220, extraordinary session, 1955. They will levy an annual tax to assure that necessary funds will be available as needed.

The installation of the project will have impacts on the environment. The installation will reduce gross erosion, reduce long-term sediment deposition and downstream sediment delivery, reduce floodwater damages, reduce drainage damages, and improve the physical properties and fertility of the soils. There will be clearing of forest land for structural measures. Existing stream fishery resource will be detrimentally affected by the proposed channel work and forest land wildlife habitat will be lost as a result of structural measures. There will be air and noise pollution and temporary degradation of water quality during construction. Agricultural production will be lost or reduced on acres committed to structural measures.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical Data

Location and Size - Deer Creek Watershed is composed of 43,872 acres and is located in northwestern Mississippi. The watershed has 40,630 acres, 92.6 percent in the southwestern part of Bolivar County, and 3,242 acres, 7.4 percent in northwestern Washington County. Towns and/or communities in or adjacent to the watershed are Eutaw, Benoit, Bolivar, Grapeland, Hannah, Lake Vista, Lamont, Scott, Stringtown, Priscilla, and Winterville. The city of Greenville is situated approximately six miles south of the watershed. Cleveland is 20 miles to the northeast and Greenwood 45 miles to the east. The population of the watershed is estimated to be about 2,100 people.^{1/} All of these are classed as rural population.

The watershed is located approximately in the south central part of the Lower Mississippi Water Resource Region and in the west central portion of the Yazoo River Basin Sub-region.

The Lower Mississippi Region, an area of abundant natural resources, lies chiefly in the Gulf Coastal Plain and is roughly bisected by the Mississippi River.^{2/} The region is composed of 102,400 square miles of land and water. It extends from the confluence of the Ohio and Mississippi Rivers to the Gulf of Mexico. The climate of the entire Lower Mississippi Region is classified basically as humid subtropical with abundant precipitation. Winters are usually relatively mild and summers are hot.

The Yazoo River Basin Sub-region consists of the entire drainage area of the Yazoo River and its tributaries of which Deer Creek is a part. It lies entirely within the state of Mississippi and is composed of 13,355 square miles or 13 percent of the total area of the Lower Mississippi Region.

Precipitation and temperature patterns are similar to those of the Region as a whole. Topography, however, within the sub-region varies greatly. The delta portions of the basin are composed of low, relatively flat, lands in the Alluvial valley of the Mississippi River. Elevations in this area range from about 90 feet above sea level near Vicksburg, Mississippi, to about 200 feet near Tunica, Mississippi. An abrupt bluff hill line rises on the east side of the delta with sudden increases in elevation of more than 100 feet at some locations. Areas to the east of this bluff line consist of rolling to rugged hill land with valleys ranging from 0.5 to 2 miles in width. Elevations in the hills reach 640 feet near New Albany, Mississippi, and range from 300 to 500 feet throughout the hill area.

Because of its location within the Delta part of the region and sub-region the conditions and characteristics of the watershed are similar to the conditions and characteristics in those areas. Topography is relatively

^{1/} U.S. Department of Commerce, County and City Data Book, Bureau of the Census, 1972.

^{2/} Lower Mississippi Region Comprehensive Study, Volume 1, Appendix C, December, 1973.

flat. Winters are mild and summers are hot and humid. Rainfall distribution patterns as a rule are good for the growth of most field crops.

Soil and Water Resource Problem Areas - Deer Creek, being a delta watershed, has less than 5,000 acres of lands with erosion hazard. Sediment and erosion damages within the watershed are moderate. Sediment produced by sheet erosion has caused some loss of capacity in channels and bayous serving as outlets, but this however, has occurred over a long period of time and is not considered a serious problem.

Flooding and lack of adequate drainage are the major watershed problems. Flooding occurs because of relatively flat topography and inadequate channel capacities. The drainage problem results partially by lack of outlets and partially by flat, low-lying, fine textured soils. There are about 27,580 acres of the watershed within which both flooding and drainage problems exist (see solid area of project map). About 16,290 acres have flooding problems only within the area (see crosshatched area on project map). The flooding only and/or flooding and drainage are so intermixed and intermingled within the entire watershed area so that they could not be individually separated on the map. The flat, low-lying fine textured soils make up a large part of this area. Normal rainfall produces excess water which keeps the soil in such a condition that normal tillage cannot be carried out properly and crop yields are greatly reduced. Sediment caused by erosion has caused loss of capacity in some channels and bayous serving as outlets.

Geology - The watershed lies entirely within the Mississippi Alluvial Plain or "Delta" physiographic region. Geologically, the soils of this area are young. Some areas have received fresh sediments during recent geologic periods. Meanders, oxbow lakes, and crescent-shaped swamps are found within the area.

Land - The watershed lies entirely within the Southern Mississippi Valley Alluvium Land Resource Area. Land within the watershed is relatively flat, very fertile, and constitutes a highly developed farming region. The soils in addition to being nearly level, have many low-lying narrow depressions running in different directions. There are also landlocked pan type depressions with clay soils scattered throughout. Such interlaced and landlocked conditions make it impossible for the soils of this group to dry uniformly after heavy rains.

Important differences among the soils of the watershed are related to differences in parent material, age, drainage, and soil capability. All of the soils were derived from alluvium, most of which was deposited by the Mississippi River. Most soils of the watershed have clay, silty clay, silty clay loam, or silt loam textures. A few have textures of very fine sandy loam, fine sandy loam, sandy loam, or loamy sand. Slopes of from nearly level to level predominate.

The soil capability grouping is an arrangement of soils to show relative suitability for crops, grazing, forestry, or wildlife. Soils that are nearly level, well drained, free from overflow, fairly fertile, and not otherwise

limited are placed in class I. They are widely adaptable. The farmer can use his class I soils for crops without special practices and can choose one of several cropping systems. If he wishes, he may use the soils for pasture or for some other purpose. Soils are placed in class II if they are a little less widely adaptable and thus more limited than those in class I. A gently sloping soil must be farmed in such a manner as to control erosion. Other soils may be in class II because they are too droughty, too wet, too sloping, too shallow to be in class I.^{1/} Class III contains soils that are suitable for regular cropping but that have narrower adaptations for use of more stringent management requirements than those in Class II. Soils that are even more limited and that have narrower crop adaptations than those of class III but are still useable for tillage part of the time or with special precautions are placed in class IV.

The watershed can be divided into three major soil groupings or soil associations. The westernmost portion of the watershed, along the eastern edge of the Mississippi levee, is composed of soils of the Commerce-Robinsonville-Crevasse soil association. Principal soils of this grouping are Commerce, Robinsonville, Crevasse, and Mhoon, all of which are on recent natural levees. The less extensive Dowling and Souva soils are in depressions or the channels of former streams. In general, the relief is nearly level, but some small areas are gently sloping. The soils are neutral to alkaline. All of the principal soils are easily worked. The principal soils are in capability classes I, II, and IV. They are the most productive in the watershed and much of this association is used for row crops. The principal crops are cotton, soybeans, and corn. A small acreage is used for small grains and pasture. These soils are protected from overflow by the Mississippi levee system.

Soils of the Forestdale-Dundee-Bosket association make up much of the northern, eastern, and central parts of the watershed. This association consists of soils developed on old natural levees and in depressions and channels of former streams. Principal soils are Forestdale, Dundee, Dubbs, Bosket, Beulah, and Clack. All are found in old natural levees. Dowling and Souva soils occupy depressions or channels of former streams and also occur as narrow strips within large areas on the old natural levees.

In general, the relief is nearly level but a few narrow strips have slopes which range from 7 to 10 percent. The soils are strongly acid to slightly acid. Their drainage ranges from poor to excessive. The soils are in capability classes I, II, III, and IV. They are among the most productive soils of the watershed. Cotton is the principal crop. Some parts of the association are used for soybeans, corn, small grains, hay, and pasture. Only a small part is in forest.

Interspersed in the central and southern parts of the watershed are the soils of the Dowling-Alligator-Sharkey soil association. Principal soils are the Alligator, Sharkey, and Tunica on slack water flats and the Dowling which occurs in depressions or former stream channels. The relief is nearly level to gently sloping on most of the association. Some areas are level, however, and occasional narrow strips have strong slopes. Soil reactions range from strongly acid to neutral. The Alligator soils are most acid. The soils are difficult to work. Most of them have fine textured clayey

^{1/} Soil Survey, Bolivar County, Mississippi, Series 1959, No. 5.

surface soils and subsoils. They are mostly in capability classes III and IV but some are in capability class II. Most of the association are used for crops. Cotton is grown on a majority of the soils. Because cotton yields have been decreasing due to increasing wetness, some of the acreage formerly used for cotton is now used for soybeans, rice, hay, and pasture.

Climate - The climate of the watershed area is the humid sub-tropical type. Summers are hot. Winters are mild. In the winter the temperature seldom drops below zero degrees or climbs above 70^o F. Summer temperatures seldom rise above 100^o F or fall below 60 degrees. The average yearly temperature is 63.8 degrees. The growing season for the watershed amounts to approximately 220 days as the average frost free period extends from March 27 to November 2.

Rainfall is fairly well distributed throughout the year. Normally, during the summer, there are no prolonged wet or dry periods. There are, however, occasional dry periods that last long enough in summer to injure crops and pasture. At times wet periods last long enough to injure crops, particularly on the poorly drained soils. The heaviest precipitation comes in winter and spring and local flooding is not unusual. The annual rainfall for the watershed area, based on records of the U.S. Weather Bureau at Scott, Mississippi, is 48.36 inches. The wettest month is December with 5.65 inches of rainfall and the driest month is September with 2.92 inches.

Ground Water and Mineral Resources - Water for domestic use is supplied from drilled wells and dug wells. Water for livestock use is supplied by drilled wells but some pond or creek water is used to supplement these wells. Abundant ground water resources underlie the Yazoo River Basin, of which the watershed is a part.^{1/} Data indicates that water is available to the watershed area from five different fresh water aquifers. These include the Mississippi River Alluvium, the Cockfield Formation, the Sparta Sand, the Basic City Shale Member, and the Meridian-Upper Wilcox aquifer. Much of the ground water being used in the watershed is being drawn from the Mississippi alluvial aquifer which underlies the entire Yazoo River Basin area. This aquifer is composed of sands and gravels and averages about 80 feet in thickness. It is replenished principally by infiltration of precipitation from permeable upper layers. Water from this aquifer is moderately mineralized and hard, and generally contains up to 16 milligrams per liter of iron in solution.^{2/} It is used for irrigation, mainly for rice, and where treated, can be used for municipal uses. A study of data from approximately 20 deep wells in the general area of the watershed indicates that water is being used from depths of over 1,800 feet. The majority of the deep wells, however, draw water from a depth of from 400 to 800 feet.

Generally, there is sufficient moisture during the growing season for the production of crops. There are, however, occasional dry periods that last long enough in summer and fall to injure crops and pastures.

There are no gas or oil wells within the watershed, however, there are several gas pipelines which cross the watershed in different directions.

Land Use - The present land use in the watershed is 79 percent cropland, 3 percent grassland and perennials, 12 percent forest land, and six percent

^{1/} Lower Mississippi Region Comprehensive Study, December 1973.

^{2/} Water for Industry and Agriculture in Washington County, Mississippi 1971.

other land. Cropland areas are scattered throughout the watershed. Forest lands are concentrated mainly in the northern and westernmost parts of the watershed and are located mostly adjacent to depressions and stream channels. Sizeable acreages of forest land are located near both ends of Lake Bolivar, a 662 acre oxbow lake, located in the upper left hand portion of the watershed near the Mississippi River. Approximately 20,368 acres of land are subject to flooding annually in the watershed. Land uses of these acreages include cropland, pastureland, and municipal uses (roads and bridges).

The land within the watershed is divided between private and public ownership. Privately owned lands constitute 41,787 acres or 95.2 percent of the watershed. Public lands make up the remaining 2,085 acres (4.8 percent). These are Sixteenth section school lands which are administered by their respective County Board of Supervisors. There are no Federal lands within the watershed.

The average size farm in the watershed is 363 acres.

Surface Water Resources - Surface water resources within the watershed consist of both natural and man-made channels which make up Deer Creek and its tributary streams, Lake Bolivar, Saw Grass Lake, and small ponded areas both natural and man-made.

Lake Bolivar is located in the northwestern part of the watershed near the town of Scott. It is five miles long and contains 662 acres of surface water.^{1/} It is, like many of the larger lakes in the Delta region, an oxbow lake, the remains of an old Mississippi River Channel. The lake is classified for use as fish and wildlife. This means that its waters are intended for fishing and for propagation of fish, aquatic life, and wildlife.^{2/}

Saw Grass Lake is a 175 acre wooded wetland area located in the eastern part of the watershed. It is an important waterfowl and wildlife area and is used for waterfowl management purposes.

The stream system of the watershed is made up by Williams Bayou and Deer Creek and its tributaries. The system contains both natural and man-made channels. Deer Creek, the major stream of the watershed, is made up by East Branch and Straight Bayou along with numerous smaller tributaries. Deer Creek proper forms as an outlet of Lake Bolivar. The creek flows from its source southeasterly to the southern boundary of the watershed where it is joined by Williams Bayou and by East Branch. East Branch and its tributary, Straight Bayou, begin in the northeast part of the watershed near an old Mississippi River Channel and flow southward until they join in the east central part of the watershed, then continue to the south until joining with Deer Creek proper at the southern boundary of the watershed. Williams Bayou, which forms the southwestern and southern boundary of the watershed begins in the western part of the watershed near the Mississippi River Levee system. It flows in a southwesterly direction to its confluence with Deer Creek proper in the southeastern part of the watershed.

^{1/} State Wide Lake and Stream Survey, Mississippi Game and Fish Commission, 1969.

^{2/} Water Quality Criteria for Interstate and Intrastate Waters, Air and Water Pollution Control Commission, State of Mississippi, April 24, 1973.

Streams of the watershed, for the most part, are classed as intermittent because they flow during parts of the year, but have little or no flow during other parts. Laterals and field ditches in the upper reaches of the larger streams and their tributaries are classed as ephemeral because they flow only during periods of surface runoff and are dry otherwise.

The table (following page) illustrates chemical and physical stream data for specific locations and conditions.

Wetlands - There are about 89 acres of Type 7 wetlands along channels 2 and 3 in the northeastern portion of the watershed and about 435 acres of Type 7 wetlands along proposed channels 1 and 5 in the central and southern portions of the watershed.

Economic Data

The watershed area is of an agricultural nature with farming and related industries being of vital importance to its economy. Cotton, soybeans, and rice are the principal sources of cash farm income. Cotton production decreased 47 percent during the 20-year period from 1949 to 1969 and increased 56 percent from 1969 to 1972. Soybeans acreages have been on the increase. Acreage harvested for beans increased about seven times during the 1949 to 1970 period. Acreage has leveled off since 1970 varying with planting season weather conditions. Rice acreage in 1969 was 80 percent of what it was in 1954. These crop acreages and percentages are for Bolivar and Washington Counties but are representative of the Deer Creek Watershed. The number of livestock reached a peak in 1954, was reduced consistently until 1969, and has leveled off since that time.

The average annual gross income from the sale of farm products in Bolivar and Washington Counties amounts to \$28,240 per commercial farm of which 97 percent is from crops and 3 percent is from livestock. In 1969 approximately 51 percent of the farms of this area received less than \$5,000 gross income from the sale of farm products. With the cost of production deducted from these sales, net return would be much less. Approximately 28 percent of the farm operators worked off farm because of low farm income, with about 15 percent working off the farm 100 days or more per year.

Low income-producing family type farms are scattered throughout the watershed. It is estimated that less than 50 percent of the agricultural land in the benefited area is devoted to farms using 1-1/2 man-years or more of hired labor.

The flood plain lands have an estimated value of \$400 per acre and the non-flood plain land an estimated value of about \$500 per acre.

Bolivar and Washington Counties, of which the watershed is a part, are areas that have been designated as being economically depressed. They are designated as Area Redevelopment Act Counties in Mississippi. Project Installation will include many of the objectives of the Overall Economic Development Plan and will promote the Rural Area Development efforts in these counties.

STREAM DATA--CHEMICAL AND PHYSICAL ANALYSES

Deer Creek Watershed, Mississippi

Parameters	Interflow				24 Hr.				Storm Runoff			
	Sample Stations		Sample Stations		Sample Stations		Sample Stations		Sample Stations		Sample Stations	
	1	2	3	4	1	4	3	4	1	1	3	3
	Range of Values											
Dissolved Oxygen, mg/l	4.4 - 5.2	5.4 - 5.5	5.5 - 6.0	5.1 - 5.3	4.4 - 4.4	6.2:3.9	5.9:3.7	5.5	4.0 - 4.6	4.4 - 4.7		
Flow, cfs	60 - 70	60 - 70	55 - 65	35 - 40	60		35	55	60 - 95	60 - 95		
Nitrate, mg/l	0.05	0.06 - 0.11	0.08	0.08 - 0.15	-				0.09 - 0.13	0.09 - 0.14		
pH	6.1 - 6.4	6.4	6.4	6.3 - 6.5	6.1 - 6.6	6.3 - 6.3	6.8:6.1	6.6	6.3 - 6.7	6.3 - 6.7		
Pesticides												
Methyl Parathion, ppb	0	0	0	0					0	0		
Toxaphene, ppb	0	1.8 - 3.1	2.4 - 2.5	1.5 - 2.4					0.96 - 2.0	0.66 - 2.01		
Total Phosphorus, mg/l	0.08 - 0.16	0.04 - 0.20	0.03 - 0.26	0.07 - 0.21					0.17 - 0.28	0.18 - 0.29		
Ortho Phosphorus, mg/l												
Total Solids, mg/l	166 - 177	172 - 173	108 - 160	96 - 163					323 - 809	247 - 454		
Total Suspended Solids, mg/l	30 - 46	27 - 46	28 - 31	14 - 50					12 - 38	14 - 48		
Total Dissolved Solids, mg/l	120 - 147	126 - 146	77 - 132	46 - 149					306 - 786	215 - 406		
Specific Conductance, Micromhos/cm	240 - 252	228 - 250	225 - 250	192 - 205					470 - 552	439 - 470		
Temperature												
Air, °C	31 - 33	32 - 34	32 - 34	32 - 35	19 - 32	19 - 32	19 - 32	19 - 32	28 - 31	28 - 31		
Water, °C	25 - 28	27 - 30	27 - 30	28 - 32	24 - 27	24 - 27	25 - 29	25 - 29	26 - 27	26 - 28		
Turbidity, JTU	< 25	< 25	< 25	< 25					< 25	< 25		

Local and county roads cross the watershed in various directions. Mississippi Highway No. 1 and a branch of the Illinois Central Gulf Railroad cross the watershed from north to south. Mississippi Highway No. 450 crosses the watershed from west to east and Mississippi Highway No. 448 forms the northeastern boundary of the watershed. The county and state roads along with the railroad provide easy access to nearby business areas and markets.

Fish and Wildlife Resources

Wildlife habitat resources within the watershed are varied and though limited in quantity are of excellent quality and distribution. Deer, squirrel, rabbit, quail, and doves are found in abundance in the watershed. Some turkey are found in the forest lands near the Mississippi River levee system. Waterfowl populations are high during the winter months when they use bayous, wetlands, and farmlands as feeding and resting areas.

It is a common practice in the Mississippi Delta to dam the swales that are present in cropped areas with small earth fills and culverts. This practice enables landowners to flood these depressions, which contain waste grains, to a depth of one to two feet. These areas provide attractive feeding areas for the abundant wintering waterfowl population. Rice and soybean fields are often managed in this manner with the waste grain often providing as much as 15 percent of the total amount of harvested grain, which is high quality waterfowl food for waterfowl utilization.

Although not as common, some waterfowl foods such as Japanese millet, are planted in swales which are too wet to crop, or in the beds of old lakes or sloughs. Winter rains and backwater from the larger watercourses generally flood these areas and make the planted foods available for use by waterfowl.

Wood ducks, the only native duck in the watershed area, use cypress and other trees that have suitable hollows for nesting sites.

Saw Grass Lake, a large wooded wetland area in the eastern portion of the watershed is an important waterfowl and wildlife area which is used for waterfowl management purposes. Extensive river front forest lands near the western edge of the watershed, though not in the watershed, contain large populations of wildlife and influence the game population within the watershed.

Fur bearing animals known to be present in the watershed area include beaver, muskrat, and mink. Alligators have been known to have lived in the area in times past. None are known to exist in the watershed at present.

Fishery resources consist of Lake Bolivar, a 662 acres oxbow lake, Saw Grass Lake, and assorted bayous and creeks. Lake Bolivar has adequate game fish population and both it and Saw Grass Lake are used for fishing by local residents. Fishery resources in the creeks, sloughs, brakes, and bayous are of low value. Water quality is fair to poor and water levels fluctuate drastically.

The stream fishery is limited within the watershed due to several factors that presently contribute to ecological problems within the watershed's streams. A fish population sample conducted on September 25, 1974, within the main channel of Deer Creek approximately one mile east of Scott, revealed that this section of stream yielded a relatively large fish standing crop (490.73 lbs/ac). However, the majority of the sample consisted primarily of small and undesirable species. Although one sample at a selected point within the watershed is hardly enough evidence to remark conclusively about the stream fishery resource watershed-wide, the presence of common limiting factors throughout the watershed would reduce the possibility of an adequate stream fishery occurring.

The lack of flow within most of the watershed's streams has a pronounced effect upon the stream fisheries. Streams within the watershed are classed as intermittent and ephemeral. Seasonal drying during summer months frequently limits their water to small shallow holes which are subject to summer stagnation and oxygen depletion. As a result only those fish species which are capable of tolerating low oxygen concentrations occur within these streams and even they are subject to other limiting factors which may reduce their numbers or eliminate their presence. The streams with moderate flow during certain parts of the year, for example the sample location, lack a desirable fishery resource due to factors apparently unrelated to flow in this case, poor water quality, high pesticide content, and lack of habitat diversity.

Previous stream alteration is another aspect contributing to the poor fishery resource. Most of the watershed's streams have had some previous channel modification, and though in certain instances the changes have been made long enough ago to permit complete revegetation of the channel banks and partial retrogression of the stream to a meandering course, the adverse effects of channel alteration upon the stream fisheries is still apparent.

Probably the most pronounced factor limiting the fishery resource is the widespread use of pesticides within the watershed. Most of the watershed is agricultural with the majority of the land use being dedicated to row crops, which involve the use of pesticides in their cultural requirements. There is evidence of pesticide concentrations within many of the faunal inhabitants of the watershed and many species, especially those occupying the higher trophic levels of the food chain, have become eliminated due to intolerance of high pesticide accumulations formed through the process of biological magnification.

The existing fish population appears to possess significant intrinsic problems which reduces the quantity and quality of the present sport fishery. Only one specimen of a carnivorous fish species, the spotted gar (Lepisosteus oculatus), was recovered in the population sampling. Without the presence of predator fish to prey on the forage species, the present population has become extremely "out of balance". The population sample (see data, following page), reflects this phenomenon very vividly in that the predominance of the forage species has caused stunting in all members of the lower trophic levels and provides the reason for the large number of small fish within

Deer Creek Fish Population Sample

Location: Approximately 1 mile east of Scott, Mississippi
 Date: September 25, 1974

Approximately 100 yards of stream

Stream condition: Good flow, water murky, stream previously channelized

Noxfish (5% rotenone) - 3.5 pints

Potassium permanganate - 7 pounds

Total sample weight - 60.85 pounds

Approximate standing crop - 490.73 lbs/acre

<u>Species</u>	<u>Common name</u>	<u>Number</u>	<u>Length (in)</u>	<u>Weight (lb)</u>
<u>Lepisosteus oculatus</u>	Spotted gar	1	18	1.15
<u>Dorosoma cepedianum</u>	Gizzard shad	6	7	.75
		3	4	.15
		3	3	.10
		8	2	.05
<u>Notemigonus chrysoleucas</u>	Golden shiner	3060	2-8	38.25
<u>Noturus gyrinus</u>	Tadpole madtom	54	2	.50
<u>Ictalurus natalis</u>	Yellow bullhead	2	8	.50
		2	7	.25
		4	5	.25
		4	3	.15
<u>Gambusia affinis</u>	Mosquitofish	17	2	-
<u>Lepomis cyanellus</u>	Green sunfish	1	4	.05
		11	3	.15
		30	2	.40
<u>Lepomis humilis</u>	Orangespotted sunfish	1160	2	7.05
<u>Lepomis macrochirus</u>	Bluegill	2	6	.50
		5	5	.50
		30	4	1.50
		45	3	1.75
		175	2	3.50
<u>Lepomis megalotis</u>	Longear sunfish	3	4	.15
		10	3	.45
		55	2	2.75

the sample. No species of game fish was recovered of harvestable size. No predator species of game fish was recovered at all. Only a total of 10 species of fish were present. Previous stream channel alteration and pesticide accumulation within the stream inhabitants have contributed heavily to the "unbalanced population".

The large standing crop that seems to be present is indicative of the inherent high productivity of this watershed. Although channel alteration and pesticide use has reduced the fishery resource to a near worthless state, the basis for a good fishery potential is still present.

The Mississippi Air and Water Pollution Control Commission indicated that the Town of Benoit has a 3-cell lagoon for sewerage treatment with the lagoon discharging into Burrows Creek which is outside the watershed. They also indicated that the communities of Eutaw, Scott, and Priscilla have no sewerage facilities. They advise that there are no waste discharges in the Deer Creek Watershed to their knowledge.

Recreational Resources

Recreational resources within the watershed are restricted to those normally associated with local hunting and fishing activities. Lake Bolivar is relatively undeveloped for recreational purposes. Local watershed runoff maintains the water level of the lake and the outlet of the lake forms Deer Creek. The lake area exhibits natural scenic beauty and has potential for future recreation uses. At the present time its geographic location, plus the fact that other lake areas are more readily available, limits its use for such recreational purposes as water skiing, swimming, and camping, etc. Although Lake Bolivar is considered to be a good blue gill fishing lake, no boats are available on a rental basis. Mississippi Highway No. 1 follows part of the lake shoreline and a public park equipped with picnic tables is located between the highway and the lake shore. Duck hunting on the lake is not available as it is a duck refuge.

Saw Grass Lake, located in the eastern part of the watershed, has a privately owned waterfowl management area and provides waterfowl hunting as a form of recreation during fall and winter months. Other areas of the watershed provide recreation in the form of dove, quail, small game, and deer hunting activities.

Archaeological and Historic Values and Unique Scenic Areas

A survey of archaeological and historical sites of the watershed has been made by the Mississippi Department of Archives and History. This survey indicated the existence of 16 archeological or historical sites within and near the watershed area. These sites are recorded as 22-Bo-540, 568, 569, 575, 576, 577, 578, 579, 580, 581, 582, and 583 and 22-Ws-535, 576, 577, and 579. An additional site, the Winterville site (22-Ws-500) is located a few miles to the southwest of the watershed and is a part of the Mississippi State Park System and is state owned. The survey report states that most

of the sites were single-dwelling units or hunting camps of the Baytown period. The Metcalfe site (22-Ws-579) is considered by some as a rather important occupation area. However, it is outside the watershed boundary by quite a distance.

According to the State Historic Preservation Officer, as of December 15, 1975 there were no sites in that watershed listed in the National Register of Historic Places or the most recent monthly supplement.

The National Register criteria was used on all recorded sites within the watershed area in evaluating and determining the eligibility of properties for listing in the National Register of Historic Places.

One additional site, the Burrus House (Hollywood Plantation), within the watershed area has been approved by the Mississippi Historic Preservation Professional Review Board for nomination to the National Register of Historic Places. This site will not be affected by the project measures.

Unique scenic areas within the watershed are limited to Lake Bolivar, Saw Grass Lake, and assorted bayous. These areas contain stands of large cypress trees near their outer edges. These scenic areas are considered by many to have a high degree of aesthetic value.

Soil and Water and Plant Management Status

Crops grown primarily for market in the watershed are cotton and soybeans and limited acreage of rice. Wheat and oats grown are consumed locally as livestock feed. Cotton acreage decreased 47 percent between 1949 and 1972 and increased 56 percent from 1969 to 1972. Soybean acreage harvested for beans increased about seven times during the 1949 to 1970 period.

Soybeans acreage is expected to continue to increase, but with less rapidity, as long as near present prices prevail. Rice acreage in 1969 was 80 percent of the acreage in 1954. These crop acreages are for Bolivar and Washington Counties, but are representative of the Deer Creek Watershed. The number of livestock reached a peak in 1954, was reduced consistently until 1969, and has leveled off since that time.

A relatively good land treatment program exists in the watershed. Approximately 2,220 acres of Conservation Cropping Systems and Crop Residue Management, and 12,000 acres of row arrangements have been applied to date in the watershed. Approximately 75 miles of drainage field ditches and mains and laterals have been completed. Approximately 11,000 acres of drainage and irrigation land grading and land smoothing have been completed. Additionally approximately 3,500 acres of pasture planting, pasture management, and wildlife upland and wetland habitat management have been applied.

There are approximately 4,300 acres of land in the watershed that are subject to sheet and gully erosion. Approximately 600 of these acres are highly erodible and may be considered marginal for crop production.

Much of the land in the watershed is prevented from realizing its fullest crop potential each year because of this lack of adequate drainage and/or flood protection.

Soil and Water Conservation Districts of Bolivar and Washington Counties cover the entire watershed area. These districts function in providing local rural leadership in the fields of soil and water conservation to the farmers and landowners of the watershed. The Mississippi Forestry Commission through the going Cooperative forest management program furnishes management advice and assistance to the landowners of the forest lands in the watershed. The majority of these lands are being managed for wildlife habitat by their owners or are leased to hunting clubs.

A number of landowners are maintaining their forest lands for use by themselves and their employees. Some of these forest lands are classed as wetlands. Several of these landowners have expressed their intention to improve these forest lands for wildlife and waterfowl habitat. They have indicated that technical assistance now being provided by existing on-going programs are sufficient to this purpose.

It is a fairly common practice in this portion of the Mississippi Delta to construct or establish temporary restrictions to waterflow in the late fall and winter months to flood openland and forest land for waterfowl uses. Several landowners and some groups have expressed their intention to expand this practice.

Approximately 42 percent of the farms of the watershed are engaged in cooperative programs with the local Soil and Water Conservation Districts. Active farm plans cover approximately 67 percent of the watershed area with a majority of the planned practices applied. Partial surface drainage for most of the watershed has been provided by individual and small group efforts, assisted by Soil and Water Conservation District programs of the respective counties. This effort of on-farm assistance, however, has not been able to solve the floodwater and drainage problems of the watershed area.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land Treatment

A good land treatment program exists in the watershed. However, the local people recognize the need for additional measures.

There are approximately 4,300 acres of land in the watershed that are subject to erosion if not properly managed. Active farm plans cover 67 percent of the watershed area with a majority of planned practices applied. Sediment and erosion damages within the watershed are moderate. Sediment produced by sheet erosion has caused some deposition in channels and bayous serving as outlets. This has occurred over a long period of time and has not been considered a serious problem in the past.

With the advent and use of large pieces of agricultural machinery such as six and eight row tractors and corresponding planting, tilling, and harvesting equipment, a need has arisen for changes in field sizes and shapes. Economical use of equipment requires long rows, uniform drainage, and relatively level land. These changes have created unique management problems and have resulted in the need for specific land treatment measures and activities such as land smoothing, land leveling, row arrangement, and related land treatment measures.

Floodwater and Drainage

As shown by the project map, the entire Deer Creek Watershed has a water problem either from flooding alone as shown by the dotted areas, or from flooding in conjunction with improper drainage as shown by the solid areas.

The area that has a flooding and drainage problem makes up approximately 63% of the watershed or about 27,579 acres. This area is made up of level to undulating, poorly to somewhat poorly drained clay and mixed soils. These soils in addition to being nearly level have many low-lying, narrow depressions running in all directions. There are also landlocked pan type depressions with clay soils scattered throughout this area. These inter-laced and landlocked depressions are readily flooded and make it almost impossible for the soils in this group to dry uniformly after a heavy rain with the wetter areas becoming the limiting factor on timely land preparation, planting, cultivation, and harvest.

The area that has a flooding only problem only makes up approximately 37% or about 16,293 acres of the watershed. This area is comprised of level to gently sloping, moderately to well drained soils. The ridges and depressions in this area are more pronounced and are scattered randomly throughout the fields. In times of flooding this condition causes flooded areas in all fields which restricts land preparation, planting, cultivation, harvest, and other cultural practices for the entire field until the excess water is removed, even though only a small percentage of the field would be directly flooded.

In this watershed, as in the Mississippi Delta as a whole, the flood hazard is primarily a problem of length of inundation rather than depth. The modification in cultural practices that must take place due to the long periods of inundation in the depressions affects the yields of the entire field. Although only approximately 20,368 acres of the watershed are actually flooded, the entire watershed is affected by reduced yields and therefore reduced income from sale of agricultural products. For this reason the entire watershed will be directly benefited from reduced flooding and/or a combination of reduced flooding and improved drainage as shown by the project map.

Flooding within the watershed area has not resulted in any recent loss of life and has caused no ill effects on the health of the residents of the watershed. However, the excess water provides excellent habitat for mosquitos that are carriers of encephalitis, a virus which caused 36 deaths in the state in the summer of 1975 and is expected to be present again in 1976. Of the 36 deaths confirmed by the State Board of Health, 16 were in Washington and Bolivar Counties.

Present channels provide about 40 percent effective drainage. The drainage problems are created primarily by lack of adequate outlet channels for water disposal systems. Partial surface drainage for most of the watershed has been provided by individual and small group efforts, assisted by Soil and Water Conservation District Programs of Bolivar and Washington Counties; however, these efforts have not been sufficient to solve the floodwater and drainage problems.

Irrigation Problems

Of the total land in the watershed approximately 35,000 acres are considered as agricultural cropland and as such have potential for irrigation during dry periods of the summer and early fall.

Irrigation is used in the watershed and in the general area of the watershed as a supplement to rainfall for the purpose of increasing crop yields.

Potential sources of water for irrigation include ground water from wells, water from ponds, lakes and bayous, and water from old Mississippi River channels. The latter is pumped over the river levee and piped and channeled to needed agricultural areas. Abundant ground water resources underlie the watershed area. Data indicates that water is available from five different fresh water aquifers. Much of the ground water used is drawn from the Mississippi Alluvial aquifer which underlies the entire region. This aquifer is composed of sands and gravels and averages about 80 feet in thickness. The water from this aquifer is moderately mineralized and hard, and generally contains up to 16 milligrams per liter of iron in solution.^{1/} It is used for irrigation, mainly for the production of rice.

Irrigation systems presently in operation are adequate for present needs. Future needs will be dependent on crop demands and the availability of necessary capital and labor.

^{1/} Water for Industry and Agriculture in Washington County, Mississippi, 1971.

The fine textured soils of the watershed are suited for irrigation with rice and rice-soybean combinations. The lighter soils are better suited for irrigation with cotton, soybeans, and other crops grown in the area.

The control of weeds and other unwanted vegetation is generally accomplished by use of herbicides applied either before or after planting operations, by herbicides applied during crop growth, and by mechanical cultivation.

Fish and Wildlife

Problems confronting fish and wildlife population in the watershed include those of: (1) Pollution of lakes and streams by agricultural chemicals, including insecticides, herbicides, fertilizers, and defoliants. (2) Removal of water from lakes for irrigation purposes. (3) Siltation or sedimentation of fishery resources as a result of flooding and/or natural runoff. (4) Clearing and/or removal of wildlife habitat in the form of timber stands and resulting land use changes.

Pollution of lakes and streams by agricultural chemicals is a by-product of modern agricultural technology and is present in the waters of the watershed as it is throughout the delta region. Pollutants include fertilizers and plant foods, herbicides, and insecticides. These materials are used in large amounts in normal farming operations. They become dissolved in floodwaters and washed into nearby streams.

Irrigation has been a problem in the past when Lake Bolivar, in 1954, was pumped almost dry and for several years thereafter experienced poor fishing. This situation has since been corrected. Deer Creek has several small earth filled dams. Associated ponds and deep holes within the creek have been used for irrigation purposes with resultant water level fluctuations.

Sediment is ever present as a source of pollution, especially where the ground surface is disturbed one or more times during the course of a year.

Last but not least, drainage tends to lead the way for clearing of woodlands and changed land uses, especially in fertile agricultural areas. This results in loss of wildlife habitat and/or change from one type of habitat to another.

Alligators are known to have lived in the waters of the area. There are no reports of any in the watershed area at this time.

Economic and Social Problems

Bolivar and Washington Counties of which the watershed is part, are areas that have been designated as Area Redevelopment Act Counties in Mississippi. Approximately 31 percent of the farm operators work off farms because of low farm incomes. About 12 percent work off farms more than 100 days per year. In 1969, approximately 51 percent of the farms received less than \$5,000 gross income from farm products. With the cost production deducted from these sales, net returns would be much less. The low income producing

family type farms are scattered throughout the watershed. It is estimated that less than 50 percent of the agricultural land in the benefited area is devoted to farms using 1 1/2 man-years or more of hired labor.

Installation of project measures within the watershed will include many of the objectives of the overall Economic Development Plan and will promote the Rural Area Development efforts in these counties.

PROJECTS OF OTHER AGENCIES

Natural drainage within the watershed flows into Deer Creek, an authorized project of the Vicksburg District, U. S. Corps of Engineers.

Representatives of the Corps have indicated that it would be possibly 20 years before the Corps would make plans for the works of improvements on the main Deer Creek channel. It was further indicated that it was agreeable with the Corps for the SCS to provide sponsor assistance for the system of channels upstream from the Town of Priscilla.

The Deer Creek Water Management District will clear trees, brush, and obstructions from the flow area of Deer Creek through the reach from the outlet end of the watershed project downstream to the airport road or Nonomi Bridge. The clearing of this reach of the downstream channel will assure a smooth transition of the design flow at the watershed outlet downstream into the portion of Deer Creek on which no channel work is planned by the Corps of Engineers at this time. This work will be accomplished before or in conjunction with the construction of the upstream PL-566 channel work, even though the existing channel has a capacity equivalent to or exceeding the capacity of the proposed channels which were sized by the formula $Q = 40 M^{5/6}$ and computed through use of water surface profiles and flood routings with the storage in Lake Bolivar and a low area in the vicinity of Station 340+00 of Main Deer Creek given due values.

This particular watershed has been studied and evaluated as a part of a cooperative effort with the Corps and USDA studies in the Sunflower River Basin.

Representatives of the Corps stated, after two additional consultation meetings, that they are no longer concerned that the upstream channel work will significantly increase the danger of downstream flooding.

Other projects include loans made by the Farmers Home Administration to the village of Benoit for a water and sewer system and to the Winterville Water Association to serve the Winterville area.

PROJECT FORMULATION

The Deer Creek Water Management District was organized under Article 2, Chapter 7, title 19, Section 4675 as amended, of Mississippi code of 1963, annotated. On March 26, 1965, Chancellor of the Chancery Court of Washington County, Mississippi, entered decrees, creating, organizing, and establishing the Deer Creek Water Management District, naming the Commissioners and conferring upon such District all powers enumerated in enabling legislation.

Formal application was made by the officials of the Deer Creek Water Management District and the Soil and Water Conservation Districts of Bolivar and Washington Counties for federal assistance under the Watershed Protection and Flood Prevention Act, in preparing and carrying out plans for works of improvement for the Deer Creek Water Management District located in the State of Mississippi.

A field examination of the Deer Creek Water Management District was conducted on August 16, 1965, by representatives of the SCS. The examination included a reconnaissance of the watershed, a study of the land use, crops, frequency and duration of floods, a study of the needs of drainage and flood prevention, the condition of the stream channels, the condition of the outlet portion of Deer Creek, and the sources of sediment and the extent of sediment damage.

Following the field examination, a meeting was held with two of the watershed commissioners and their attorney, other interested landowners, the Area Conservationist, and the District Conservationist of Bolivar County. During the meeting, responsibilities, costs, and other matters relating to planning the watershed were discussed. The local sponsors indicated a sincere desire to proceed with developing a watershed work plan on this watershed. They indicated their willingness to cost share on the drainage cost and to furnish easements and rights-of-way for construction and operation and maintenance purposes.

A request was made by the State Conservationist to the Administrator, SCS, in Washington, D.C. on May 14, 1969, requesting a planning start for Deer Creek Watershed.

The intervening time between the initial field examination and the request for planning start was spent in the preparation of a watershed work outline and developing supporting data.

During the spring of 1970 concern by the sponsoring organization was shown as to the status of the watershed project. Delays were attributed to a backlog of watershed survey work.

A meeting was held between members of the SCS on May 13, 1970, to discuss engineering surveys in Deer Creek Watershed.

Preliminary survey work was to begin in the Deer Creek Watershed on May 26, 1970. There was a need to arrange a meeting with the watershed commissioners to discuss future work in the watershed.

A meeting was held September 17, 1970. Representatives of both the sponsoring organization and the SCS were present. The purpose of this meeting was to inform the Watershed Commissioners and their Attorney of the progress to date of the planning of the watershed.

During the fall of 1970, a need was shown by representatives of the SCS for information regarding activities by U. S. Corps of Engineers in the Deer Creek Watershed area.

During October 1970, there was a revision of the watershed size from 47,577 acres to 43,872 acres. This change necessitated a revision of some supporting data.

During October 1970, decisions were made concerning the responsibilities of the SCS and Corps of Engineers in regard to which agency would be responsible for channel work in the different parts of Deer Creek.

A meeting was held on May 26, 1971, at Greenville, Mississippi, between Deer Creek Watershed District Commissioners and selected SCS personnel. Watershed planning, tentative channel alignment, rights-of-way, and cost sharing were discussed.

A meeting was held January 20, 1972, with representatives of the sponsoring organization and the SCS and landowners present. The purpose of the meeting was to discuss cost, cost-sharing, responsibilities of the Sponsors and the Service, maintenance and protection of wildlife areas, installation of green-tree reservoirs, environmental aspects pertaining to the watershed, and other matters relating to watershed planning.

During May, 1972, the U. S. Corps of Engineers, Vicksburg District, advised SCS that SCS could take over work on Deer Creek above Priscilla, Mississippi.

A meeting was held August 29, 1972, between representatives of the sponsoring organization and the SCS. The purpose of this meeting was to bring the sponsors up-to-date on the planning of the watershed to determine if the sponsors were willing to accept the responsibility of cost sharing on the construction of the main Deer Creek Channel from Priscilla to Scott.

An inter-agency wildlife review of the watershed was made October 31, 1972. Participants included representatives of the Mississippi Game and Fish Commission, the U. S. Fish and Wildlife Service, and the SCS.

A public meeting was held on March 21, 1974. The purpose of this meeting was to (1) fully inform the landowners on whose property the works of improvement are to be installed; (2) inform other landowners or residents in the watershed who might be assessed to help finance the works of improvement; (3) inform all special interest groups who might be concerned over the effects of the projects on the environment, and (4) to inform the general public.

Meetings were held in March and June of 1975 with representatives of the U. S. Corps of Engineers to determine the adequacy of the plan designs. Apparent problems were resolved to the mutual satisfaction of the SCS and the Corps of Engineers.

The Mississippi Air and Water Pollution Commission was consulted in July of 1975 relative to waste discharges in the Deer Creek Watershed. There were none to their knowledge.

According to the State Historic Preservation Officer, as of December 15, 1975 there were no sites in that watershed listed in the National Register of Historic Places or the most recent monthly supplement.

The National Register criteria was used on all recorded sites in evaluating and determining the eligibility of properties for listing in the National Register of Historic Places.

The Deer Creek Watershed work plan is in harmony with the Comprehensive Yazoo River Basin Report and the Northwest Mississippi RC&D plan.

Objectives

The overall objective as related to land use and treatment and the plant community is to provide adequate cover and treatment for watershed lands so that the land itself will be protected from erosion, so that rainfall can be retained or drier upland soils thus reducing runoff to lower wetter areas, and so that the movement of sediment to lower elevations within the watershed and downstream will be reduced. Some specific goals for achieving adequate treatment during the project installation period are: (1) to treat 20,449 acres of cropland and 1,820 acres of grassland adequately; (2) to treat other lands of the watershed so that they approach being adequately treated; and (3) to treat the land in such a manner that the land cover will provide a source of income for the owner, provide habitat for wildlife, and provide a pleasing surrounding for rural living.

The objective as related to the level of flood damage protection for the watershed is to provide sufficient reduction in flooding so that the agricultural land of the watershed will be directly benefited. These improvements will serve both flood prevention and agricultural water management (drainage) purposes. Specific goals for achieving adequate flood damage protection are the installation of approximately 50 miles of channel clearing and/or enlargement on Deer Creek and its tributaries and the installation of approximately 150 pipe overfall structures, one weir and several water level control devices.

Another objective of the project is to provide both a short and long term stimulus to the economy of the watershed area. This will be provided through (1) employment of local people during the installation period of the project and for maintenance of the project measures in periods after installation, (2) increase of the income of low income farm families and small landowners of the watershed, by improving quality and quantity of crops produced, and (3) improvement of the municipal utilities of the watershed through construction of new bridges at channel crossings.

The maintaining of environmental balance with nature is an objective of the project. Goals for accomplishing this objective include: (1) selective construction procedures such as working from one side of the channel

where practical, (2) installation and maintenance of wetland areas for wildlife habitat, (3) installation of the weir structure in Deer Creek to assist in the maintenance of adequate surface waters in Lake Bolivar, (4) preservation of den trees and food supplying trees along channel banks, (5) minimal destruction of wildlife and fishery habitat, and (6) establishment of wildlife supporting vegetation at earliest practical opportunity.

Environmental Considerations

Primary consideration was given to the biological environmental balance of the more intensely farmed portions of the watershed, including erodible upland areas and lower flatter areas subject to flooding. Incorporation of land treatment measures and removal of excess water benefit the tilth and structure of the soil. Incorporation of organic matter and crop residues result in increased water infiltration rates and available water holding capacities. Plant food availability values and pH values are changed. A combination of these factors creates favorable impacts on the soil environment with regard to the growth of bacteria, fungi, actinomycetes, earthworms, and other micro- and macro-organisms that make their home in the soil environment.

Considerations relating to fish and wildlife within the watershed resulted in the omission of approximately 11 miles of channel work in the drainage area above Lake Bolivar. It was felt that fish and waterfowl resources in the lake would be adversely affected by increased sediment from the farming areas to the north and west of the lake.

Several large hardwood areas in the northwestern, western, and southern parts of the watershed were given prime consideration because of their wildlife habitat value and possible adverse impacts that the project would have on them. Fifty wood duck nesting boxes will be installed within the confines of Saw Grass Lake as mitigation for the drainage of 89 acres of Type 7 wetlands adjacent to channels 2 and 3.

Saw Grass Lake, a 175-acre wetland area in the eastern part of the watershed, except for the installation of the fifty wood duck boxes, will remain as it now is. It is presently used as a waterfowl management area.

In consideration of possible adverse impacts of the project on stream fishery resources, approximately 132 miles, or 73 percent of the watershed streams, have not been included in the project.

Consideration was given to inevitable environmental changes to fish and wildlife resources resulting from necessary channel construction activities. These changes will be reduced by use of procedures designed to keep adverse impacts to an absolute minimum. Procedures to minimize adverse effects will include the preservation of the wetland areas for wildlife habitat, preservation of den trees and food supplying trees along channel banks, construction from one side of the channel where practical, and planting of vegetation on exposed channel banks as soon after construction as possible. This will reduce erosion and provide food and cover for wildlife.



Consideration was given to possible adverse impacts to downstream areas as a result of excessive flows during and after periods of high rainfall in the watershed area. Evaluations were made of the downstream stages both without and with proposed project measures in place. There was no significant increase in downstream stages, measuring from none for the smaller storms up to 0.2 feet for the larger storms.

There will be no displacement of people, businesses, or farm operations as a result of implementation of this project.

Alternatives

A number of alternatives were considered in the project evaluation process. The more reasonable of these alternatives were evaluated to the point of estimating costs and impacts. Among the alternatives considered were (1) establishment of needed land treatment in the watershed at an accelerated rate, (2) accelerated land treatment plus channel clearing, (3) accelerated land treatment, flood proofing, and conversion of land to less intensive uses, (4) land treatment combined with a series of levees, pumps, and drainage gates, (5) land treatment in combination with excavated floodway, and (6) no project.

The alternative of establishing land treatment measures involves the measures described under the heading of WORKS OF IMPROVEMENT TO BE INSTALLED - Land Treatment Measures. They include cropland measures such as conservation cropping systems, crop residue management, drainage field ditches, drainage mains and laterals, drainage land grading, land smoothing, row arrangement, spoil bank spreading, wells, and grade stabilization structures. Measures used on pastures include pasture planting, pasture management, drainage field ditches, drainage mains and laterals, and farm ponds. Wildlife measures include wildlife upland habitat management and wildlife wetland habitat management.

The use of this alternative would eliminate the adverse impacts associated with the installation of planned structural measures. Erosion would be reduced an estimated 25 percent. The physical condition of the soil would be improved, soil compaction would be reduced, soil aeration will be improved, and water infiltration rates would be increased. Biological populations within the soil would be increased because of incorporation of organic matter and better aeration. This in turn would increase the breakdown of materials within the soil and provide a better plant-soil relationship.

Fish and wildlife habitat within the watershed would be improved through such measures as ponds, stocking and management of ponds for fish, odd area wildlife plantings, vegetation of eroding acres, and wildlife habitat improvement. Floodwater damages would be reduced approximately 3 percent initially but would become progressively less as channels continue to deteriorate.

The cost of this alternative was estimated to be \$697,600.

A second alternative considered consisted of a combination of land treatment measures and channel clearing. Land treatment measures would consist of those activities listed in the first alternative plan. Channel clearing activities would include the removal of trees, snags, and sediment from approximately 50 miles of stream channels. Channel clearing measures would consist of the cutting of brush and trees within the channel banks at ground level with chain saws or similar type equipment, snaking to the top of the banks and thence to disposal areas. Logs partially submerged and firmly lodged in the bottom areas of the channel would not be removed. In above bank right-of-way areas, a minimum of clearing for access, work and disposal areas would be performed. The use of this alternate would retain the favorable impacts as listed for the alternate of establishing needed land treatment. Possible adverse impacts would result to stream fishery resources as a result of the removal of trees and snags from the channel proper.

Adverse impacts would also result to small fur bearing animals and other wildlife that use these areas for routine life activities.

Channel clearing of this type would, by removal of major obstructions from channel areas, increase the velocity of water over normal flow by one-fourth of one percent per mile. Studies indicated, however, that with use of this alternate, sufficient flood protection would not be attained in the more intensely farmed parts of the watershed.

It was estimated that the cost of this project would amount to \$1,098,400.

A third alternative was accelerated land treatment, floodproofing, and the conversion of areas with flooding potential to uses less susceptible to flood damage. This alternative would retain the favorable effects of the land treatment only alternative and would eliminate all of the adverse impacts previously described for structural measures. In order to floodproof the existing roads, bridges, railroads, and other property involved, it would be necessary to raise their useable levels above the elevation of the 100-year storm. About 30 miles of road, 8 miles of railroad, 20 bridges, one pipeline and several utilities would be affected. The conversion of present agricultural land to uses less susceptible to flood damage would require changed land use of about 20,368 acres now used for growing crops and improved pastures.

Positive impacts in the form of increased wildlife and fishery resources would occur. This land use conversion would result in an extensive adverse impact to the economy of the watershed area. It is estimated that an annual loss of crop production valued at \$700,000 would result from the use of this alternative. The estimated total cost of this alternative would be in excess of \$15,000,000.

An alternative was considered using a combination of measures consisting of needed land treatment measures and a series of levees and pumps. This alternate consists of about 1,000 acres of leveed storage areas on one

or both sides of selected stream channels at particular locations with combined usage of pumps and one way flow culverts to remove water from agricultural lands adjacent to the storage areas.

Use of the alternate would retain the favorable impacts as listed for the alternate of establishing needed land treatment. It would reduce flooding within the watershed favorably to other alternatives considered.

The use of this plan would necessitate the committing of approximately 1,000 acres of prime agricultural lands to water storage areas.

Adverse impacts to wildlife and stream fishery habitat would be avoided. Storage areas could be used for irrigation purposes during dry periods.

Possible operation and maintenance problems could arise with a project of this type due to levee bank erosion and normal wear of pumping equipment. The cost of this alternative was estimated to be about \$3,232,000.

An alternative was considered using a combination of accelerated land treatment and excavated floodway. This alternate would retain the favorable impacts associated with the land treatment only alternate but would require extensive construction of new channels. Channel activities would require the construction of a channel of increasing size as one proceeds downstream. This would result in near total destruction of the stream fishery resources and major clearing of hardwood timber along the channel rights-of-way. This alternate would increase the flood stages downstream from the construction areas due to concentration of flood flow. Adverse impacts would result to stream fishery resources and wildlife habitat. Downstream channels would not be able to contain peak flows. This would result in potential flooding hazard to downstream agricultural areas and towns. The cost of this alternative was estimated to be \$4,617,600.

The no project alternative would not eliminate or lessen any of the problems that exist in the watershed. Adverse impacts resulting from the planned project would be eliminated, however. This alternative would not reverse the trend of more frequent and more intense flooding on 20,368 acres of agricultural lands of the watershed subject to excess water problems. Stream channels would continue to fill with brush, trees, and other obstructions causing flood damages to escalate to the point that cultivated and pasture areas would be abandoned in favor of water tolerant plants. This would result in a loss of income to the people of the area and would worsen the social problems. It is estimated that a net annual benefit of \$219,200 would be lost if this alternative course of action is used.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

An effective conservation program based on the use of each acre of agricultural land within its capabilities and treatment in accordance with its needs is necessary for a sound flood prevention and agricultural water management program. Land treatment measures are to be planned and applied by individual farmers in cooperation with the Soil Conservation District consistent with the District's objective and this plan.

Land treatment measures are to be planned, applied, and maintained on the public lands by the land administering agency in charge of these lands. These measures have been jointly agreed upon by the land administering agency, the sponsors, and the Soil Conservation Service. The amounts and estimated costs of the land treatment measures scheduled for installation are shown in Table 1.

Land treatment measures planned for the cropland consist of conservation cropping systems, crop residue management, drainage field ditches, drainage mains and laterals, drainage land grading, irrigation land grading, land smoothing, row arrangements, spoil bank spreading, wells, and grade stabilization structures. The measures planned for pastures and hay lands consist of pasture planting, pasture management, drainage field ditches, drainage mains and laterals, and farm ponds. Forest land treatment measures will be carried out through improved harvesting methods undergoing cooperative forest management programs. Wildlife measures include wildlife upland habitat management and wildlife wetland habitat management.

Conservation cropping systems are the growing of crops in combination with needed cultural and management measures and include crop rotations. Crop residue management (crop residue use) is the use of plant residues to protect cultivated fields during critical erosion periods. A drainage field ditch is a graded ditch for collecting excess water within a field. A drainage main or lateral is an open drainage ditch constructed to a designed size and grade. Drainage land grading is the reshaping of the surface of the land to be drained by grading to planned grades. Irrigation land grading or irrigation land leveling is the reshaping of the surface of the land to be irrigated to planned grades. Land smoothing is the removal of irregularities on the land surface by use of special equipment. Row arrangement is the arrangement of crop rows in such a way as to facilitate and control row drainage. Wells include the construction or improvement of wells to provide water for irrigation, livestock, wildlife, or recreation. Grade stabilization structures are structures to stabilize grade or control head cutting in natural or artificial channels.

Pasture planting consists of establishing and reestablishing long-term stands of adapted species of perennial, biennial, or reseeding forage plants. Pasture management includes the proper treatment and use of pasture land or hay land. Ponds are impoundments made by constructing a dam or embankment or by excavating a pit or dugout.

Conservation plans will be developed by the individual farm operator and the appropriate soil and water conservation district for about 46 of the 53 farm operating units in the watershed. Approximately 64 percent of the now existing and active plans will be revised to reflect updated needs. The development and revision of the conservation plans and technical assistance for installation of the land treatment measures will be accomplished through going programs supplemented by accelerated programs developed with PL-566 funds.

Structural Measures

Multiple Purpose Channels - Planned structural measures consist of 50.1 miles of multiple purpose channel work to provide additional capacity for drainage and disposal of runoff from the watershed. The channels were sized to meet the capacity requirements computed by the formula $Q = 40 M^{5/6}$, where Q equals runoff in cubic feet per second, and M equals contributing drainage in square miles. However, the storage provided by Lake Bolivar and a sump or low area in the vicinity of station 340+00 along Main Deer Creek combined with the fact of Deer Creek becoming a perched stream at the lower end of the watershed limits the quantity of flow moving through the channel to somewhat less than design flow.

Channel work will consist of excavation, clearing, shaping, disposal of spoil, installation of pipe overfall grade control structures, and water level control structures. A weir will be located at approximately station 50+00. The purpose of this structure will be to allow floodwater to move out of Lake Bolivar during periods of high flood stage and to maintain a constant water level in the lake during periods of low flow.

The channel work will serve both flood prevention and drainage purposes. The rate of runoff provided by the design criterion $Q = 40 M^{5/6}$ was used

as the basic design of all channel improvements. This design capacity will provide for the removal of 1.50 inches of runoff in 24 hours from one square mile drainage area. A channel designed for this capacity will reduce existing floodwater damage to crops and pastures by 60 percent.

The formula $Q = 40 M^{5/6}$ was selected as the basis for channel sizing computation because of the agreement between the Corps of Engineers and the Soil Conservation Service that the upstream channel capacities would be limited to the capacity capability of the downstream channels to accept the upstream flows without exceeding the design flow lines as the flow moves downstream. Channels with sizing as computed by this formula and resultant flows will provide an adequate level of protection for sustained agricultural use.

Materials through which the channels are to be constructed are medium to highly plastic clays (CL+CH) with isolated lenses of silty sands (SM) and clayey sands (SC). Channels B-1, 5, 7, and 8 are man-made channels. All others are natural channels. Some maintenance has been done in the past, but no coordinated program has been carried out.

Planned channel work varies from channel clearing and shaping to channel enlargement (See project map, Figure 4). The 50.1 miles of channel work consist of 13.66 miles of channel clearing and shaping (channel work type-class III), and about 36.49 miles of channel enlargement (channel work type-class II).

Planned channel work on main Deer Creek below the weir structure, at Scott, (see project map) is as follows: From station 50+00 to station 206+50, channel enlargement is planned. Some large trees outside the flow area will be left. Channel clearing is planned from station 206+50 to station 266+00. The present channel widens out in this reach and further enlargement is not necessary. Large cypress trees growing near the channel banks will be preserved. Fallen trees, sediment bars, and other debris will be removed from the flow area. Channel enlargement is planned from station 266+00 to station 560+00. Some large trees will be left along the channel banks. The width of the proposed channel requires that construction be performed from both sides of the channel. Channel clearing and shaping is planned from station 560+00 to station 662+00.

County road bridges or culverts at stations 94+00, 175+00, 295+00, 335+50, 385+50, and Mississippi State Highway 450 culverts at station 206+50 will be replaced at local expense.

County road bridges at station 440+50 and station 560+50 will be reinforced. One pipeline at station 459+40 will be lowered.

Channel activities on East Branch Deer Creek, a tributary, are as follows: Channel enlargement is planned from station 50+00 to station 408+00. Much of this reach has been cleared in the past. Channel clearing of woody vegetation, sediment bars, and other debris is planned from station 408+00

to station 580+00. The construction of this channel is to be done from one side. Large trees outside the flow area will be left intact. Saw Grass Lake will not be affected by this channel as flow from this lake is controlled by a water level control structure.

New bridges will be required at stations 282+50 and 354+00.

Channel activities on Williams Bayou, in the southern part of the watershed, are as follows: Channel enlargement is planned from station 50+00 to station 250+00. Many of the large cypress and other larger trees growing outside the flow area will be left. Channel clearing and shaping will be done from station 250+00 to station 637+00. Groves of pecan trees along the stream bank will be preserved by construction from one side. Many of the large cypress trees outside the flow area will also be left. New culverts will be installed at stations 61+00, 124+00, 157+00, 190+00, 287+00, and 377+00. The spoil in the vicinity of the St. Joseph Church and cemetery will be placed on the south side of Williams Bayou.

Activities on channel No. 1, located in the north central part of the watershed are as follows: Channel enlargement is planned for its entire length from station 47+00 to station 452+00. Channel construction will be performed from one side. Excavation spoil from station 379+00 approximately to station 450+00 will be placed on the north side to form a levee. Water level control gates installed through the levee will allow water to be maintained in a wetland area to preserve wildlife habitat.

The Mississippi Highway No. 1 bridge at station 116+00 and county road bridges at station 200+00 and station 379+00 will be replaced. The railroad bridge at station 116+00 will be reinforced. The cost of reinforcement is included in estimated costs (see Table 2).

Channel activities on channel B-1 in the extreme northeastern part of the watershed consist of channel enlargement which is planned for the entire length of this channel from station 50+00 to station 84+00. One culvert, underlying a county road, will be lengthened and lowered.

Channel C-1, also in the northeastern part of the watershed, follows an existing channel for most of its length from station 86+00 to station 143+25. Channel enlargement is planned for most of this distance with a short section of new channel. Construction will be done from one side.

Activities on channel No. 2, also in the northeastern part of the watershed include channel enlargement for the entire length from station 50+00 to station 224+50. Construction will be done from one side. Large trees outside the flow area will be preserved. The culvert capacity under a county road will be increased at station 89+00.

Channel activities on channel No. 3, located in the northeast part of the watershed will include channel enlargement for its entire length from station 50+00 to station 127+00. Construction will be performed from one side of the channel. One county road culvert at station 95+00 will be replaced.

Channel No. 5, in the southern part of the watershed, will be enlarged for its entire length from station 50+00 to station 160+00. Channel construction will be accomplished from one side. Two water level control structures are planned. These will allow the preservation of present wildlife habitat in adjacent wetland areas.

New bridges will be constructed at stations 56+00, 73+50, 89+00, 105+00, 121+00, and 160+50.

Channel No. 7, located in the southern part of the watershed, will be enlarged its entire length from station 50+00 to station 82+00. Construction work will be accomplished from one side of the channel. The spoil in the vicinity of St. Joseph Church and cemetery will be placed on the east side of channel No. 7.

Channel No. 8, also in the southern part of the watershed, will be enlarged from station 50+00 to station 79+00. A new culvert will be installed at station 74+50. Channel construction will be performed from one side of the channel.

Overexcavation for sediment traps is planned in the following channels: Main Deer Creek, East Branch, Williams Bayou, and channels Nos. 1 and 5. Earth-blocks will be spaced out to hold water and to reduce vegetation in the channel bottoms.

Adverse effects to the stream fisheries and wildlife resources have been carefully considered in planning channel work features. Planned channel measures have been kept to an absolute minimum to achieve floodwater control objectives. All areas to be cleared will be revegetated as soon as reasonably possible.

Fifty wood duck nesting boxes will be constructed in the confines of Saw Grass Lake as mitigation for drainage of approximately 89 acres of Type 7 wetlands which lie adjacent to channels Nos. 2 and 3.

Temporary and permanent vegetation is planned for maintenance roads, disposal areas, and all channel banks where the natural vegetation and/or banks are disturbed during construction. Construction will be scheduled to provide the maximum length growing season practical to allow reestablishment of the vegetation. Vegetative measures will be included in construction contracts.

Design data, channel capacity, and other pertinent data for planned channel work are included in Table 3A. Illustrations of typical channel sections are shown in Figures 1, 2, and 3.

There are no relocations and/or displacements resulting from the acquisition of land rights for the structural measures included in this watershed.

Data relative to land rights, committed use of land and availability for public use is presented in the following table.

TABLE A

Channel Name or Number	Structural Measures: Land Rights: Needed (acres)	Type: 1/	Present Land Use:		Future Land Use ^{2/} :	
			Open	Woods	Open ^{3/}	Woods
Main Deer Creek	268	PE	145	123	268	0
East Branch Deer Creek	168	PE	86	82	143	25
Williams Bayou	140	PE	37	103	111	29
No. 1	121	PE	26	95	84	37
No. B-1	8	PE	8	0	8	0
No. C-1	12	PE	12	0	12	0
No. 2	40	PE	9	31	29	11
No. 3	17	PE	9	8	15	2
No. 5	29	PE	25	4	28	1
No. 7	8	PE	8	0	8	0
No. 8	9	PE	9	0	9	0
Total	820	--	374	446	715	105

1/ PE = Perpetual Easement

2/ Channel use is included in Future Land Use Figures.

3/ Future Land Use - Open land includes some trees.

Installation Procedures - Structural Measures - Soil erosion and water, air, and noise pollution will be minimized by following SCS Engineering Memorandum-66 and applicable state guidelines to reduce erosion and pollution. Measures which will be followed to reduce erosion and sedimentation are: (1) limiting the exposure of erodible soils to the shortest time reasonably possible; (2) use of temporary vegetation where the exposure of erodible soils will be excessive; (3) retardation of runoff by mechanical means where necessary; and (4) trapping sediment in sediment traps. Measures which will be used to reduce water, air, and noise pollution are: (1) application of water on haul roads and construction areas for control of dust during construction; (2) use of temporary bridges and/or culverts on running streams; (3) careful handling of fuel, oils, and lubricants to reduce spillage; (4) maintenance of construction equipment including engines and exhaust systems; (5) regulation of burning at construction sites to proper burning conditions; and (6) location of access and haul roads as far as possible from residential homes.

The Federal Register, National Register of Historic Places, dated February 4, 1975, as corrected April 1, 1975, was consulted and no registered properties within the area were found.

A professional archeologist employed by the Mississippi Department of Archives and History has made an archeological and historical survey of the watershed. This survey indicated the existence of 16 archeological or historical sites within and near the watershed area. These sites are recorded as 22-Bo-540, 568, 569, 575, 576, 577, 578, 579, 580, 581, 582, and 583 and 22-Ws-535, 576, 577, and 579. An additional site, the Winter-ville site (22-Ws-500) is located a few miles to the southwest of the watershed and is a part of the Mississippi State Park System and is state owned. The report states that most of the sites were single-dwelling units or hunting camps of the Baytown period. The Metcalfe site (22-Ws-579) is considered by some as a rather important occupation area. However, it is outside the watershed boundary by quite a distance.

According to the State Historic Preservation Officer, as of December 15, 1975, there were no sites in that watershed listed in the National Register of Historic Places or the most recent monthly supplement.

The National Register criteria was used on all recorded sites within the watershed area in evaluating and determining the eligibility of properties for listing in the National Register of Historic Places.

EXPLANATION OF INSTALLATION COSTS

Land Treatment Measures

Land treatment measures will be installed at an estimated total cost of \$697,600, of which \$37,500 will be financed from P.L. 566 funds and \$660,100 will be financed from other funds (See Table 1).

The P.L. 566 funds are for additional technical assistance to accelerate the land treatment program. Other funds are for installation of land treatment measures and technical assistance. Activities included are preparation and revision of conservation farm plans and the planning and establishment of land treatment practices.

Structural Measures

Multiple-Purpose Channels - Multiple-purpose channels, including pipe overfall structures, and water level control gates for the preservation of wetlands, are to be installed at an estimated total cost of \$2,185,200 of which about \$1,437,400 will be financed from P.L. 566 funds and \$747,800 will be financed from other funds (See Table 2).

The costs were allocated to flood prevention and drainage on the basis of the relationship of wet and non-wetland in the drainage area of the channel. Costs allocated to flood prevention amount to \$1,498,400 and \$686,800 to drainage. Of the total installation cost of the multiple-purpose channels, 68.57 percent is allocated to flood prevention and 31.43 percent to agricultural water management (drainage). Table 2A shows the cost allocation and cost sharing.

The construction costs of the multiple-purpose channel work will be shared by P.L. 566 funds and Other funds. The P.L. 566 share is \$1,284,800, and the Other fund share is \$239,500. Of the total funds for construction purposes, \$198,800 will be used for pipe overfall structures and \$27,000 will be used for reinforcement bridge piers. Costs for engineering amounts to \$152,600 and will be from P.L. 566 funds. These funds will be used for making detailed surveys, designs, and for preparing plans and specifications. Land rights costs, under Other funds, amount to approximately \$508,300. This includes funds for replacing bridges, lowering pipelines, and replacing culverts.

Project Administration

The total cost for administering this project is estimated to be \$274,300, of which \$259,100 will be P.L. 566 costs and \$15,200 will be from Other funds. The P.L. 566 funds are for construction inspection and other expenses including administrative expenses. The Other funds costs of project administration are for advisory services and other expenses.

The unit costs used in this project are based on actual construction costs in the State of Mississippi and on the actual value of land and services in the watershed.

Estimated Schedule of Funds by Project Years

<u>Project Year</u>	<u>PL-566 Funds</u>	<u>Other Funds</u>	<u>Total</u>
	- - - - -	- Dollars - - - - -	- - - - -
<u>First</u>			
Land Treatment	12,500	220,000	232,500
Subtotal	12,500	220,000	232,500
<u>Second</u>			
Land Treatment	12,500	220,100	232,600
Structural Measures	815,500	480,000	1,295,500
Subtotal	828,000	700,100	1,528,100
<u>Third</u>			
Land Treatment	12,500	220,000	232,500
Structural Measures	621,900	267,800	889,700
Subtotal	634,400	487,800	1,122,200
Project Administration	259,100	15,200	274,300
Total	1,734,000	1,423,100	3,157,100

EFFECTS OF WORKS OF IMPROVEMENT

Flood Prevention, Erosion, and Sediment

The installation of land treatment measures will effect a decrease in watershed erosion of about 20 percent. The reduction in erosion through land treatment along with the sediment trap capability of the multiple purpose channels will reduce the amount of sediment available for overbank deposition, for downstream deposition, and for causing turbidity in streams of the watershed and in downstream areas from 470 mg/l to 414 mg/l or approximately 12 percent. The planned conservation land treatment and land use measures will improve the hydrologic characteristics of the soil allowing for greater water infiltration and soil moisture holding capabilities. Physical properties and fertility of the soils will be improved, resulting in greater yields and higher quality produce.

Structural measures in conjunction with land treatment measures will effect a reduction in the frequency and depth of flooding of approximately 20,368 acres of watershed lands. This will reverse the trends toward channel filling, loss of capacity, and increased flood frequency. The reduction of floodwater and drainage damages on the agricultural lands will be accomplished by the reduction of overbank runoff by approximately 60 percent.

The depth of flow below the project area will be increased approximately 0.2 foot for the 100-year, 24-hour storm and 0.1 foot for the 25-year, 24-hour storm. Increase in stages for frequencies less than the 25-year frequencies will be insignificant and range from none to 0.1 foot.

The project impact in reducing erosion and sediment rates, except during the construction period, will have the effect of making the waters of lakes, ponds, and streams less turbid and, therefore, more attractive for fishing and recreation. The reduction of erosion resulting from more ground cover will provide better wildlife habitat. The reduction of sedimentation will prolong the life of lakes and ponds.

There will be changes in land use and cover as a result of the project action. In the rights-of-way channel work, which is estimated at 820 acres, there will be a conversion of 341 acres of forest land to open land. The installation of the project will result in a change of approximately 359 acres from cropland to grassland and other land.

Fish and Wildlife

The improved cover conditions, the wildlife food plantings, and the wildlife preservation will increase and improve habitat suitable for wildlife. With the improvement of wildlife habitat, it is expected that there will be corresponding improvement in the wildlife resources of the watershed.

The intensity of right-of-way land clearing through wooded areas will vary according to the work type and degree of work needed. The 36.49 miles of channel enlargement will require almost all the right-of-way, with the exception of some selected trees to be cleared. The 13.66 miles of channel clearing and shaping will have less effect on the forest canopy than channel enlargement activities. Land use class will remain that of forest. Channel construction activities will result in a decrease of the forest land wildlife habitat of the watershed by 341 acres and an increase of the open land wildlife habitat of the same amount.

Construction activities will result in lower water tables in the immediate vicinity of improved channel reaches. This will affect timber growth and mast production and may eventually induce changes in the plant community. Soils of the proposed channel area are, for the most part, fine textured, clayey type materials, and therefore effects with relation to lowered water table will be limited in extent.

Approximately 50 miles of the 182 miles of channels within the watershed will have altered fishery habitat because of channel work. The effects on the fishery habitat and resources will vary with the intensity of the channel work and the present condition of the resource. The proposed channel work will contribute to the loss of the existing stream fisheries resources. It will cause a decrease in stream diversity and fish production immediately after channel work. There will be a loss of fish food and cover, and a decrease in pounds of fish per acre per area of water.

Fisheries resources will be enhanced by the reduction of sediment and associated agricultural chemicals in lakes and stream areas of the watershed. The over-excavation for sediment traps will create small pools in the channels and provide habitat for species inhabiting a lentic environment.

Channel activities will result in the probable drainage of approximately 89 acres of wetland areas (Type 7, wooded swamps), located along channel Nos. 2 and 3 in the northeastern part of the watershed. This will be mitigated by the installation of 50 wood duck nesting boxes within the confines of Saw Grass Lake. Approximately 435 acres of wetlands (Type 7, wooded swamps) will be preserved in the present state for use by wildlife and waterfowl adjacent to portions of channels Nos. 1 and 5 in the central and southern portion of the watershed.

Economic and Social

The overall economy of the area will be benefited by project action. Added employment as a result of the project action will amount to the equivalent of 5.4 man-years each year during the three-year construction period. After the construction period is over, it is estimated that 127.4 man-years of employment will be provided each year. This increased employment will tend to lower the unemployment rate which has been consistently high over the past years.

Better agricultural efficiency and income stability can be obtained by the farmers of the watershed in that the crops and pastures can be placed on lands where yields will be higher and more assured.

The quality of living for the people of the watershed will be enhanced through relief from flooding damages, reduction in agricultural production costs, increase in agricultural yields, reduction in vector habitat, and less interruption of transportation and services facilities.

The rural area of the watershed will be stabilized to the extent that people will be afforded a greater opportunity to remain on the land due to increased income necessary for living. Their improved income will allow them to maintain and improve necessary community facilities. The project will tend to keep an area which has been strong agriculturally, available for increased agricultural production as needed by the national economy.

Agricultural production will be increased per acre as follows: Cotton from 675 lbs to 850 lbs; rice from 45 cwt to 52 cwt; wheat from 30 bushels to 35 bushels; soybeans from 25 bushels to 35 bushels; and pasture yields from 300 lbs of beef to 350 lbs. It is estimated that production costs will be reduced per unit as follows: Cotton - four cents per pound; rice - 53 cents per bushel; wheat - 12 cents per bushel; soybeans - 51 cents per bushel; and beef production by one cent per pound. The quality of the harvested crops will be increased because of reductions of untimely harvesting delays due to flooding and related water problems.

Employment opportunities and standards of living of the people of the watershed including minority population, will be increased through direct activities and indirect effects of the project. Approximately 121 farmers or landowners, of whom approximately 40 are of the minority population, and 2,100 people who reside in the watershed will benefit either directly or indirectly from the project. All of the farmers or landowners will be directly benefited and their employees, employees' families, merchants, and service people will be indirectly benefited.

Other

A professional archaeologist employed by the Mississippi Department of Archives and History has made an archaeological and historic survey of the watershed. The project will not affect any of the 16 sites included in the report of this survey. However, the recommendation that spoil from the channel construction of channel 7 and Williams Bayou in the vicinity of the St. Joseph's church site (22-Ws-577) be placed on the south bank of Williams Bayou and on the eastern side of channel 7 was adopted to assure no destruction at this site.

According to the State Historic Preservation Officer, as of December 15, 1975, there were no sites in that watershed listed in the National Register of Historic Places or the most recent monthly supplement. The National

Register criteria was used on all recorded sites in evaluating and determining the eligibility of properties for listing in the National Register of Historic Places.

There will be a temporary degradation of water quality in the streams below construction areas during and shortly after the construction periods due to increased erosion and sedimentation.

There will be air and noise pollution during the construction periods due to the operation of heavy equipment.

PROJECT BENEFITS

The estimated total average annual benefits, evaluated and used in project justification accruing to the works of improvement amount to \$401,300. Of this amount, \$233,100 is a result of reduction in flood damages to crops and pastures and \$101,300 is from agricultural water management (drainage) that will result in improved efficiency by providing reduced production costs per unit of production and increased units of production.

Secondary benefits claimed accrue from the production, transportation, processing and marketing of project goods and services accruing within the zone of influence of the project. Secondary benefits from a national viewpoint were not considered for this evaluation.

Other benefits accruing to the project are redevelopment benefits which amount to \$22,600. These benefits were estimated to be 20 percent of the construction costs of the structural measures of the project. These benefits will result from the construction, operation, and maintenance of the project measures by giving additional employment to the unemployed and underemployed.

Additionally, it was estimated that land treatment measures would provide flood damage reduction benefits of \$10,000 annually.

COMPARISON OF BENEFITS AND COSTS

Multiple-purpose channel improvements, including the pipe overfall grade control structures, are to be installed, operated, and maintained at an estimated average annual cost of \$171,400. Average annual benefits exclusive of secondary benefits, are estimated to be \$357,000, with a benefit-cost ratio of 2.1 to 1.0. Total average annual benefits are estimated to be \$401,300 with a benefit-cost ratio of 2.3 to 1.0 (See Table 6).

PROJECT INSTALLATION

The Works of Improvement are to be installed over a three year installation period.

Land treatment measures will be installed by farmers and/or landowners through conservation farm plans in cooperation with the Bolivar and Washington County Soil Conservation Service during the first, second, and third year of the project installation period. These measures will be planned and applied farm by farm within the watershed consistent with the objectives of the Soil Conservation District and this plan. Additional technical assistance to accelerate the installation of these measures will be provided by the Soil Conservation Service.

The Boards of Supervisors of Bolivar and Washington Counties and individual leaseholders will be responsible for installation of land treatment measures on Sixteenth Section land with Other funds.

All structural measures will be installed by Soil Conservation Service contract during the second and third project years in council with the Deer Creek Water Management District.

Project Administration responsibilities in the form of Construction Inspections will be the responsibility of the SCS. Costs of organizations, cost of legal services, and miscellaneous expenses will be the responsibility of the Deer Creek Water Management District.

All land rights for the project will be secured by the Deer Creek Water Management District. The District has sufficient legal authority (including the power of eminent domain) to acquire all necessary land, easements, and rights-of-way.

The SCS will provide engineering services for all structural measures.

Sequence of Doing Work

The works of improvement will be carried out in an orderly sequence during the three year installation period as follows:

- | | |
|------------------|--|
| 1st project year | - Land treatment measures |
| 2nd project year | - Land treatment measures
Structural measures including the following channels: Main Deer Creek, Williams Bayou, Channel No. 7, Channel No. 8 |
| 3rd project year | - Land treatment measures
Structural measures including Channel No. 1, Channel No. B-1, Channel No. C-1, Channel No. 2, Channel No. 3, Channel No. 5, and East Branch |

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the works of improvement on non-Federal land as described in this plan will be provided under the authority of the Watershed and Flood Prevention Act (P.L. 566, 83rd Congress, 68 Stat. 666) as amended.

The Water Management District will secure all land rights in connection with the multiple-purpose channel work. It is estimated that 820 acres of land will be needed for land rights. It is expected that land rights will be donated by the local farmers of the watershed; however, funds have been set aside for the purchase of land rights in the event that they are not.

Land rights costs for the multiple-purpose channels were determined by the local sponsors and are estimated to be \$200 per acre. Bridge and culvert alterations were evaluated individually in accordance with needed changes.

The sponsors plan to apply for a Farm Home Administration loan to purchase any necessary land rights that are not donated to finance necessary administrative costs for cost sharing on the multiple-purpose channels, and for any other costs that may be incurred in the installation of the planned works of improvement. In addition, an annual tax will be levied to assure that necessary funds will be available as needed.

Land treatment measures will be established by individual landowners and operators. They will utilize any assistance program that is available at the time of installation.

The Water Management District has requested the Soil Conservation Service to administer all contracts. The District will finance its share of project costs utilizing the loan provisions of Sec. 8, P.L. 566 as amended by P.L. 1018. The loan will be repaid through assessments as provided by Mississippi Senate Bill 1220, extraordinary session 1955.

The Board of Supervisors of Bolivar and Washington Counties and individual leaseholders will be responsible for installation of land treatment measures on Sixteenth Section land with other funds.

Financial and other assistance to be furnished by the Soil Conservation Service in carrying out this project under P.L. 566 is contingent upon the appropriation of funds for this project.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures on private land will be operated and maintained by landowners and operators under cooperative agreements with the Soil Conservation District of their respective county. The operation and maintenance of these measures will be the financial responsibility of the individual operators and landowners. Land treatment measures on public lands are to be operated and maintained by the land administering agency in charge of these lands or by individual farmers or operators having leases on these lands.

The Water Management District will assume the responsibility to operate and maintain the multiple-purpose channels, including the water level control devices for the preservation of wetlands. Operation and maintenance funds will be secured through assessments as provided in Mississippi Senate Bill 1220, extraordinary session, 1955. The estimated annual cost for operation and maintenance of the multi-purpose channels is \$12,600. This cost includes \$2,600 annual replacement cost for the pipe overfall grade control structures due to their expected life of 30 years.

Joint inspections will be made annually by the sponsors and the Soil Conservation Service official responsible for operation and maintenance inspections. They will also make inspections after unusually severe floods and after the occurrences of any other unusual conditions that might adversely affect the structural measures. These inspections will continue for a period of three years following construction. Inspections after the third year will be made annually by the sponsors. They will prepare a report and send a copy to the Soil Conservation Service official responsible for operation and maintenance inspections and follow-up where needed. The Soil Conservation Service official may continue to provide assistance after the third year as determined by the State Conservationist.

The maintenance of the flood prevention channels will be accomplished by the use of sprays approved by the U. S. Environmental Protection Agency for use adjacent to aquatic areas and/or labor and equipment to control noxious weeds and unwanted vegetation. Care will be taken in the application of sprays to prevent drift to adjoining land areas. The maintenance of stream banks will promote the growth of desirable vegetation for stream bank erosion control and wildlife habitat. Where sprays are used for maintenance, their use will conform to applicable laws and/or rules and regulations. Additional maintenance will include the removal of drifts, debris, and/or sediment bars as necessary.

Travelways for maintenance of structures will be constructed as a part of the construction contract. These travelways will be adequate for movement of operation and maintenance equipment required for maintenance of the channels. They will be maintained as a part of the channel system.

Detailed plans for operation and maintenance will be contained in the Watershed Protection Operation and Maintenance Agreement, which will be executed prior to issuing invitations to bid on construction work. The State Operations and Maintenance Handbook will be used as a guide in preparing the Watershed Protection Operation and Maintenance Agreement. The Operation and Maintenance Agreement will include specific provisions for retention and disposal of property acquired or improved with PL-566 financial assistance.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Deer Creek Watershed, Mississippi

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) ^{1/}		
			PL-566 Funds		Total
			Non-Fed Land	Other Funds	
			SCS ^{3/}	SCS ^{3/}	
<u>LAND TREATMENT</u>					
<u>Land Areas^{2/}</u>					
Cropland	Ac.	20,449	0	555,900	555,900
Pastureland	Ac.	1,820	0	94,700	94,700
Technical Assistance			37,500	9,500	47,000
TOTAL LAND TREATMENT			37,500	660,100	697,600
<u>STRUCTURAL MEASURES</u>					
<u>Construction</u>					
Multiple-Purpose Channel Work ^{4/}					
(N)	Mi.	46.2	1,184,200	220,700	1,404,900
(M)	Mi.	3.9	100,600	18,800	119,400
Subtotal - Construction			1,284,800	239,500	1,524,300
<u>Engineering Services</u>			152,600	0	152,600
<u>Relocation Payments</u>			0	0	0
<u>Project Administration</u>					
Construction Inspection			152,400	0	152,400
Other			106,700	14,200	120,900
Relocation Assistance					
Advisory Services			0	1,000	1,000
Subtotal - Administration			259,100	15,200	274,300
<u>Other Costs</u>					
Land Rights			0	508,300	508,300
TOTAL STRUCTURAL MEASURES			1,696,500	763,000	2,459,500
TOTAL PROJECT			1,734,000	1,423,100	3,157,100

1/ Price base 1975

2/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas, not just to adequately treated areas.

3/ Federal agency responsible for assisting in installation of works of improvement.

4/ Type of channel before project: (N) - an unmodified, well-defined natural channel or stream; (M) - man-made ditch or previously modified channel.

TABLE 1-A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of work plan preparation)

Deer Creek Watershed, Mississippi

Measures	Unit	Applied To Date	Total Cost (Dollars) ^{1/}
<u>LAND TREATMENT</u>			
<u>Cropland</u>			
Conservation Cropping System	Ac.	2,220	2,300
Crop Residue Management	Ac.	2,220	2,300
Drainage Field Ditches	Mi.	50	19,500
Drainage Mains and Laterals	Mi.	25	39,000
Drainage Land Grading	Ac.	3,000	156,000
Irrigation Land Leveling	Ac.	7,174	746,100
Land Smoothing	Ac.	1,200	37,400
Row Arrangement	Ac.	12,000	12,500
Spoilbank Spreading	Ft.	85,856	5,400
Well	No.	70	39,300
Grade Stabilization Structure	No.	110	33,200
<u>Grassland</u>			
Pasture Planting	Ac.	1,563	68,300
Pasture Management	Ac.	1,563	1,600
Drainage Field Ditches	Mi.	3.2	1,200
Drainage Mains and Laterals	Mi.	2.0	3,100
Pond	No.	5	2,100
<u>Wildlife</u>			
Wildlife Upland Habitat Management	Ac.	200	500
Wildlife Wetland Habitat Management	Ac.	200	500
TOTAL	////	////	1,170,300

^{1/} Price base 1973

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Deer Creek Watershed, Mississippi
(Dollars)

Item	Installation Cost - PL-566				Installation Cost - Other Funds				Total Installation Costs	
	Construction	Engi- neering	Land Rights	Relocation Payments	Total PL-566	Construc- tion	Engi- neering	Land Rights		Relocation Payments
Channel Work										
Main Deer Creek Channel No. 1 (N)	513,000	60,900	0	0	573,900	95,600	0	284,800 ^{2/}	0	380,400
Channel No. B-1 (M)	208,900	24,800	0	0	233,700	38,900	0	52,200 ^{4/}	0	91,100
Channel No. C-1 (N)	14,100	1,700	0	0	15,800	2,600	0	2,600 ^{5/}	0	5,200
Channel No. 2 (N)	22,000	2,600	0	0	24,600	4,100	0	2,400	0	6,500
Channel No. 3 (N)	61,000	7,200	0	0	68,200	11,400	0	10,200 ^{6/}	0	21,600
Channel No. 5 (M)	32,000	3,800	0	0	35,800	6,000	0	5,400 ^{7/}	0	11,400
Channel No. 7 (M)	57,300	6,800	0	0	64,100	10,700	0	24,400 ^{8/}	0	35,100
Channel No. 8 (M)	16,900	2,000	0	0	18,900	3,200	0	1,600	0	4,800
East Branch Williams Bayou	12,300	1,500	0	0	13,800	2,300	0	4,000 ^{2/}	0	6,300
Subtotal	160,600	19,100	0	0	179,700	29,900	0	67,000 ^{10/}	0	96,900
	186,700	22,200	0	0	208,900	34,800	0	53,700 ^{11/}	0	88,500
	1,284,800	152,600	0	0	1,437,400	239,500	0	508,300	0	747,800
Project Administration:	////	////	////	////	259,100	////	////	////	////	15,200
GRAND TOTAL	1,284,800 ^{2/}	152,600	0	0	1,696,500	239,500	0	508,300	0	763,000

- 1/ Price base 1975.
- 2/ Includes \$198,800 for pipe overfall structures, \$40,500 for reinforcing bridge piers.
- 3/ Includes \$191,200 for replacing 6 bridges and \$40,000 to lower pipe line.
- 4/ Includes \$28,000 for replacing 3 bridges.
- 5/ Includes \$1,000 for replacing 1 corrugated metal pipe.
- 6/ Includes \$2,000 for replacing 1 corrugated metal pipe.
- 7/ Includes \$2,000 for replacing 1 corrugated metal pipe.
- 8/ Includes \$18,600 for replacing 6 corrugated metal pipes.
- 9/ Includes \$2,200 for replacing 1 corrugated metal pipe.
- 10/ Includes \$33,600 for replacing 7 corrugated metal pipes, and \$14,000 for replacing 1 bridge.
- 11/ Includes \$13,350 for replacing 7 corrugated metal pipes, and \$14,000 for replacing 1 bridge.



TABLE 2-A - COST ALLOCATION AND COST SHARING SUMMARY

Deer Creek Watershed, Mississippi

(Dollars) 1/

Item	Cost Allocation				Cost Sharing				
	Purpose		PL-566		Other		Total		
	Flood Prevention	Drainage	Total	Flood Prevention	Drainage	Total	Flood Prevention	Drainage	
Channel Work									
Main Deer Creek	654,400	299,900	954,300	459,100	114,800	573,900	195,300	185,100	380,400
Channel No. 1	222,800	102,000	324,800	187,000	46,700	233,700	35,800	55,300	91,100
Channel No. B-1	14,500	6,500	21,000	12,700	3,400	15,800	1,800	3,400	5,200
Channel No. C-1	21,300	9,800	31,100	19,700	4,900	24,600	1,600	4,900	6,500
Channel No. 2	61,600	28,200	89,800	54,600	13,600	68,200	7,000	14,600	21,600
Channel No. 3	32,300	14,900	47,200	28,600	7,200	35,800	3,700	7,700	11,400
Channel No. 5	68,000	31,200	99,200	51,300	12,800	64,100	16,700	18,400	35,100
Channel No. 7	16,200	7,500	23,700	15,100	3,800	18,900	1,100	3,700	4,800
Channel No. 8	13,700	6,400	20,100	11,000	2,800	13,800	2,700	3,600	6,300
East Branch	189,700	86,900	276,600	143,800	35,900	179,700	45,900	51,000	96,900
Williams Bayou	203,900	93,500	297,400	167,100	41,800	208,900	36,800	51,700	88,500
GRAND TOTAL	1,498,400	686,800	2,185,200	1,150,000	287,400	1,437,400	348,400	399,400	747,800

1/ Price base 1975.

TABLE 3 - STRUCTURE DATA
CHANNELS

Deer Creek Watershed, Mississippi

Channel No. or Name	Sta. to Sta.	Drainage Area : Sq. Mi.	Capacity : cfs	Design : Req'd.	Channel Dimensions			Hydraulic Gradient : (ft/ft)	Bottom Width : (ft)	Side Slopes : (ft)	"n" Value	Velocities : Ft./Sec.	Excavation : Cu.-Yds.	Type of Work : Channel	Before Project : Flow Conditions
					Depth : (ft)	Grade : (%)	Flow : (cfs)								
Main Deer	50+00	27.64	636	657	.00013	20	.00013	8.5	3:1	.030	.025	1.70	40,580	II	N
	133+00	40.01	954	968	.00013	26	.00013	9.5	3:1	.030	.025	1.87	54,152	II	N
	206+00	40.01	954	968	.00013	A=615	.00013	WP=115		.030	.030	1.87		III	N
	266+00	40.01	954	968	.00013	26	.00013	9.5	3:1	.030	.025	1.87	62,085	II	N
	340+00	49.95	1,050	1,066	.00027	62	.00027	11.0	3:1	.030	.025	1.02	235,929	II	N
	418+00	54.32	1,114	1,178	.00027	70	.00027	11.0	3:1	.030	.025	1.04	54,729	II	N
	441+00	59.23	1,180	1,178	.00027	70	.00027	11.0	3:1	.030	.025	1.04	103,987	II	N
	511+00	68.17	1,343	1,386	.00027	70	.00027	12.0	3:1	.030	.025	1.09	69,211	II	N
	560+00	69.03	1,353	1,386	.00027	70	.00027	12.0	3:1	.030	.025	1.09		III	N
	93+00	0.65	28	32	.00017	6	.00017	3.0	3:1	.040	.025	0.71	4,652	II	N
	93+00	1.23	48	48	.00017	6	.00017	3.6	3:1	.040	.025	0.79	6,563	II	N
	139+00	2.41	84	88	.00017	8	.00017	4.6	3:1	.040	.025	0.92	17,217	II	N
264+50	4.00	128	127	.00055	14	.00055	6.0	3:1	.040	.025	0.66	32,139	II	N	
360+00	4.85	150	155	.00055	16	.00055	6.0	3:1	.035	.025	0.76	4,598	II	N	
408+00	4.85	150	155	.00055	A=570	.00055	WP=108		.035	.035	0.76		III	N	
460+00	7.75	221	229	.00055	A=547	.00055	WP=100		.035	.035	0.84		III	N	

TABLE 3 - STRUCTURE DATA (continued)
CHANNELS

Deer Creek Watershed, Mississippi

Channel No. or Name	Sta. to Sta.	Drainage Area Sq. Mi.	Capacity cfs	Hydraulic Gradient (ft/ft)	Bottom Width (ft)	Channel Dimensions: Depth (ft)	Slopes	"n" Value	Excavation Cu.-Yds.	Velocities Ft./Sec.	Type of Work	Before Project
Williams Bayou	50+00 135+50	1.54	57	.00007	6	5.0	3:1	.040	.98	.61	II	N
	135+50 250+00	2.43	85	.00007	8	5.6	3:1	.040	1.07	.67	II	N
	250+00 313+00	2.43	85	.00007	8	5.6	3:1	.040	1.07	.67	III	N
	313+00 526+00	3.98	127	.00007	10	6.0	3:1	.035	1.15	.82	III	N
	526+00 637+00	4.36	135	.00007	10	6.0	3:1	.035	1.15	.82	III	N
1	47+00 116+00	2.36	83	.00046	5	4.0	3:1	.040	2.22	1.39	II	N
	116+00 230+00	3.62	116	.00004	12	6.2	3:1	.035	.90	.64	II	N
	230+00 323+00	4.30	133	.00004	12	6.6	3:1	.035	.95	.68	II	N
	323+00 452+00	8.39	235	.00004	12	8.0	3:1	.030	1.03	.86	II	N
B-1	50+00 84+50	0.57	25	.0001	4	3.5	3:1	.040	.93	.58	II	M
C-1	86+00 143+25	0.44	40	.001	4	3.0	3:1	.045	2.66	1.48	II	N

TABLE 3 - STRUCTURE DATA (continued)
CHANNELS

Deer Creek Watershed, Mississippi

Channel No. or Name	Sta. to Sta.	Drainage Area : Sq. Mi.	Capacity : cfs	Hydraulic Gradient : (ft/ft)	Bottom Width : (ft)	Grade : (%)	Depth : (ft)	Side Slopes	"n" Value	Excavation : Cu.-Yds.	Velocities : Ft./Sec.	Type of Work	Before Project
2	50+00 122+00	2.08	73	.00015	6	.00015	4.6	3:1	.040	8,621	1.38	1/	2/
	122+00 224+50	3.11	103	.00015	8	.00015	5.0	3:1	.040	18,380	1.49	II	N
3	50+00 127+00	0.46	20	.00006	4	.00006	4.0	3:1	.040	17,115	.77	II	N
5	50+00 80+00	1.42	67	.00018	6	.00018	4.2	3:1	.040	13,435	1.42	II	M
	80+00 134+00	2.27	91	.00018	6	.00018	4.8	3:1	.040	26,022	1.55	II	M
	134+00 160+00	3.39	136	.00018	8	.00018	5.4	3:1	.040	6,223	1.70	II	M
7	50+00 82+00	0.58	26	.0004	4	.0004	3.0	3:1	.040	14,787	1.60	II	M
8	50+00 79+00	0.36	17	.00005	4	.00005	3.6	3:1	.040	6,384	.66	II	M

- 1/ I - Establishment of new channel including necessary stabilization measures
 II - Enlargement or realignment of existing channel or stream.
 III - Cleaning out natural or manmade channel (includes bar removal and major clearing and snagging operation).
 IV - Clearing and removal of loose debris within channel section.
 V - Stabilization as primary purpose (by continuous treatment of localized problem areas - present capacity adequate).
- 2/ N - An unmodified, well defined natural channel or stream; M () - Manmade ditch or previously modified channel; O - None or practically no defined channel.
- 3/ Pr - Perennial - flows at all times except during extreme drought.
 I - Intermittent - continuous flow through some seasons of the year but little or no flow through other seasons.
 E - Ephemeral - flows only during periods of surface runoff, otherwise dry.
 S - Pounded water with no noticeable flow - caused by lack of outlet or high groundwater table.

TABLE 3-A - STRUCTURAL DATA

GRADE STABILIZATION STRUCTURE

Deer Creek Watershed, Mississippi

Site No. or Station	Drainage Area (Sq. Mi.)	Design Cap. Prin. Spill. (cfs)	Assoc. Frequency and Duration of Storm (% chance and hours)	Drop (Feet)	Concrete (Cu. Yds.)	Type of Structure
Main Deer Creek 50+00	20.66	940	4% 1 Day 10-Day	5.0	209	Straight drop

TABLE 4 - ANNUAL COSTS

Deer Creek Watershed, Mississippi

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost ^{2/}	Operation and Maintenance Cost	Total
Multiple-Purpose Channel Work			
Approximately 50.1 miles together with appurtenances	141,100	12,600	153,700
Project Administration	17,700	--	17,700
GRAND TOTAL	158,800	12,600 ^{3/}	171,400

^{1/} Price base 1975.^{2/} Amortized for 50 years at 6 1/8 percent interest (0.06455).^{3/} Includes \$10,000 for operation, maintenance, and \$2,600 for replacement of pipe overfall structures.

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Deer Creek Watershed, Mississippi

(Dollars)^{1/}

Item	: Estimated Average Annual Damages :		: Damage Reduction Benefits :
	: Without Project :	: With Project :	
<u>Floodwater</u>	:	:	:
Crop and Pasture	: 368,300	: 147,300	: 221,000
Subtotal	: 368,300	: 147,300	: 221,000
<u>Indirect</u>	: 36,800	: 14,700	: 22,100
<u>TOTAL</u>	: 405,100	: 162,000	: 243,100

^{1/} Price base current normalized.

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURE

Deer Creek Watershed, Mississippi
(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS ^{1/}						Total	Average Annual Cost	Benefit Cost Ratio
	Damage Reduction	Drainage	Redevelopment	Secondary	Annual Cost	Ratio			
Multiple-Purpose Channel Work	:	:	:	:	:	:	:	:	:
Approximately 50.1 miles together with appurtenances	233,100	101,300	22,600	44,300	401,300	153,700	2.6:1.0		
Project Administration	////	////	////	////	////	17,700	////		
GRAND TOTAL	2/ 233,100	101,300	22,600	44,300	401,300	171,400	2.3:1.0		

^{1/} Price base current normalized.

^{2/} In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$10,000 annually.

^{3/} From Table 4.

INVESTIGATIONS AND ANALYSES

Economics

Economic investigations and analyses follow those methods approved by the SCS in benefit-cost evaluations on land and water resource projects. Land use, cropping patterns, and yields for with and without project conditions, were adapted from "An Evaluation of the Effects of Additional Flood Protection on Agricultural Production in the Sunflower River Basin, Mississippi" prepared by the Economic Research Service and Soil Conservation Service of the Department of Agriculture.

Flood prevention and agricultural water management benefits were determined as the difference in net returns with and without the project with associated cost deducted and discounted for expected participation. Benefits were allocated to purpose in the same ratio as were costs. The watershed area was classified as 37.14% dry land and 62.84% wetland in the "Atlas of Generalized Soils Maps" prepared in 1960 for the lower Mississippi River and tributaries.

The benefits and cost were allocated 68.57% flood prevention (damage reduction) and 31.43% to agricultural water management (drainage). Agricultural water management benefits include reduced costs per unit of production and increased units of production.

The associated costs include only those costs that are to be incurred during the installation period. These costs consist of annual installation, operation and maintenance for on-farm drainage field ditches, drainage mains and laterals, land grading for drainage and irrigation, land smoothing, conservation cropping system, crop residue management, row arrangement, spoil bank spreading, wells, and grade stabilization structures, pasture planting, and management and ponds. The cost per acre was based on cropland and pasture land use and was obtained by using the costs of the above-mentioned engineering and land treatment measures from Table 1 (background data).

Land rights costs (or easements) for the multiple-purpose channels were determined by the local sponsors and are estimated to be \$200 per acre. Bridge and culvert alterations and replacements were evaluated individually in accordance with the needed changes.

Current normalized prices were derived from data furnished by the United States Water Resources Council, February 1974. Current normalized prices were used in all crop, pasture, indirect and drainage benefits. Present (1975) prices were used for installation costs. Structural measures costs were amortized over a 50-year project life with an interest rate of 6 1/8% (.06455).

Redevelopment benefits were estimated to be 20% of the construction costs of project structural measures and amortized at 6 1/8% interest rate to convert to an average annual equivalent. These benefits from

operation and maintenance of structural measures were estimated to be 50 percent of the same. These benefits were limited to a 20-year period and treated as a decreasing annuity and converted to an average annual equivalent through amortization over the 50-year evaluation period. A conversion factor was applied to convert benefits to current normalized price base.

Secondary benefits of a local nature were evaluated. Benefits "stemming from" were considered to be 10 percent of the primary benefits less any indirect benefits. Benefits "induced by" were considered to be 10 percent of the added production costs as a result of the project.

The channel work serves both flood prevention and agricultural water management (drainage) purposes. When, as in this project, the joint flood prevention and drainage problems exist on the wetland in only a portion of the watershed, section 103.0221 of the Watershed Protection Handbook, provides for allocating benefits and costs between purposes. The second method was used for allocation of benefits and costs in this project. That portion of the cost of the channel work is allocated to flood prevention which is equal to the ratio of the area of non-wetland (37.14 percent) to the uncontrolled drainage area of the channel. The remainder (62.86 percent) of the cost is allocated equally (31.43 percent) each to flood prevention and drainage. The "Atlas of Generalized Soil Groupings" prepared in 1960 in connection with the Mississippi River and Tributaries Studies, was used as the basis for determining the area of wet and non-wetland within the watershed.

Construction cost allocated to agricultural water management (drainage) was cost-shared equally between PL-566 and Other funds. Construction cost allocated to flood prevention will be borne by PL-566 funds. All engineering cost will be borne by PL-566 funds. All land rights cost will be borne by Other funds (see table 2A - Cost Allocation and Cost-Sharing Summary).

The average operation and maintenance cost of approximately \$200 has been determined to be adequate for the multiple-purpose channels and was used in this evaluation.

Replacement costs were computed for the appurtenances (pipe overfall grade control structures) using an estimated life of 30 years. The sinking fund method with an interest rate of $6 \frac{1}{8}$ percent was used in computing these costs.

Benefits on the area adjacent to the PL-566 multiple-purpose channels were allocated between the Corps of Engineers' project on Deer Creek for providing outlet and this PL-566 project on a 20-80 percent judgment basis. Benefits in this watershed plan include only the 80 percent allocated to this PL-566 project.

Soil Conditions

Soil surveys have been completed on the total watershed. The soil survey maps show the type of soil, slope, degree of erosion, and major land use. A field examination was made to determine the soil cover complex conditions and to provide other work plan needs.

Land Use and Treatment

Present land use was determined by use of a stratified random sampling procedure from the soil surveys and expanded to the entire watershed. Detailed information concerning the use of cultivated land was furnished by the District Conservationist. Future land use and treatment measures needed were planned for the entire watershed based on a realistic evaluation of expanded data obtained from Conservation Needs Inventory and farm plans.

Engineering

Engineering surveys consisted of cross sections taken along the main streams and their tributaries. Mean sea level was used as a datum for elevation. Distances between cross sections were scaled from aerial photographs.

Capacities required for channel design were determined by the equation $Q = 40 M^{5/6}$ with Q representing cubic feet per second and M being the drainage area in square miles. "N" values for an aged condition ranged from .030 to .045. "N" values for "as built" condition are expected to be .025.

Main Deer Creek extends for many miles below the project area. A study was made on 23 miles of the channel below the project and the 11.6 miles within the project to determine the downstream effects of channel work within the project area.

Water surface profiles were computed and flood routing procedures were used to determine stages for flow frequencies for present conditions and future conditions with the project measures installed.

Lake Bolivar and low areas near station 340+00 provide temporary storage for floodwater and reduce the peak discharges and stages produced by storm runoff.

Discharges computed from water surface profiles downstream from station 340+00 are less than the design flows from the equation $Q = 40 M^{5/6}$. However, protection provided will be equivalent to capacity requirements of $Q = 40 M^{5/6}$ because of the temporary storage available. A table showing capacities computed from water surface profiles follows.

Station to Station		: Drainage Area:	Capacity	: Hydraulic Gradient
		: Sq. Mi.	: CFS	: ft/ft
50+00	133+00	: 27.64	: 657	: .00013
133+00	206+00	: 40.01	: 968	: .00013
206+00	266+00	: 40.01	: 968	: .00013
266+00	340+00	: 40.01	: 968	: .00013
340+00	418+00	: 49.95	: 825	: .000016
418+00	441+00	: 54.32	: 910	: .000016
441+00	511+00	: 59.23	: 910	: .000016
511+00	560+00	: 68.17	: 1070	: .000016
560+00	662+00	: 69.03	: 1070	: .000016

Velocities for "as built" conditions generally ranged from 1.06 feet per second to 2.24 feet per second. Stream velocities within channel C-1 reach 2.66 feet per second. Materials through which the channels are to be constructed are non-plastic to highly plastic clays. The allowable velocities were computed based on bank full flow and "as built" conditions. Computations for the larger channel including the PI values are shown in the following table. The velocities meet conditions set forth in T.R.-25.

A low flow weir is planned for station 50+00 on Main Deer Creek. This will maintain the lake level in Lake Bolivar and also allow high flows from the drainage area above the lake to move out without creating excessive backwater conditions in the lake.

The 25-year frequency principal spillway hydrograph was routed through Lake Bolivar and the drop structure in Main Deer Creek channel. The maximum stage in Lake Bolivar was 133.63 feet mean sea level. At this stage the weir will be submerged and channel capacity downstream will control the discharge from the lake. The structure will be an island-type installation allowing excessive flows to be by-passed. Within two days after the lake reaches its peak elevation, the water level will be drawn down to below the hydraulic grade line.

Geologic

Geologic conditions of the watershed were determined in conformity with Technical Release-25, revised, which requires pertinent soil mechanics information for soils bordering the stream channels. Hand auger borings were made at selected intervals along channel banks to provide representative profiles. Borings were made to a depth of two to three feet below preliminary channel design depth. Samples were taken for laboratory analysis to determine plasticity index and grain size.

The representative samples were laboratory analyzed by Mississippi Test Laboratory, Jackson, Mississippi, to verify the field classification of plasticity indices and grain size distribution.

Investigations and Analysis
Engineering

Allowable Velocity Computations 1/

Station	Design Capacity : cfs	Hydraulic Gradient : ft/ft	Design Channel Dimensions : Bot. Width : Depth	"n" Value : Aged : As Built	Velocities <u>2/</u> : Aged : As Built	Allowable Velocity : 3/ : Velocity	Depth Factor	Adjusted Allowable Velocity	Type of Work
50+00	657	.00013	20 : 8.5	.030 : .025	1.92 : 2.30	2.0	1.25	2.50	Enlargement Clearing Enlargement
207+00	958	.00013	70 : 9.5	.030 : .025	1.87 : 2.24	2.0	1.24	2.48	
490+00	1172	.000027	11 : 11	.030 : .025	1.14 : 1.37	2.0	1.25	2.50	
165+00	88	.00017	8 : 4.6	East Branch : .040 : .025	1.16 : 1.86	4.0	1.17	4.68	Enlargement
376+00	155	.000055	16 : 6.0	.035 : .025	1.44 : 1.74	2.0	1.25	2.50	
124+50	64	.00007	6 : 5.0	Williams Bayou : .040 : .025	0.86 : 1.38	2.0	1.18	2.36	"
287+50	143	.00004	12 : 6.6	.035 : .025	0.85 : 1.16	2.0	1.16	2.32	
115+50	95	.00046	5 : 4	Channel No. 1 : .040 : .025	1.67 : 2.67	4.0	1.21	4.84	"
285+50	143	.00004	12 : 6.6	.035 : .025	0.87 : 1.04	2	1.21	2.42	

1/ These computations were made for those channel reaches that will be constructed in natural materials.

2/ All velocities shown are for bank full.

3/ >10 shows plasticity index greater than 10.

<10 shows plasticity index less than 10.

A Rapid Dispersion Test (Crumb Test) was made on representative samples of the silty clays and clays. Little or no reaction was observed.

Additionally, field observations were made of the present channel banks and general field observations were made throughout the watershed.

No evidence of dispersion was noted along the banks of the present channels observed.

Hydraulic and Hydrologic

The hydraulic and hydrologic analyses were made using the method entitled "Hydrologic Measurements for the Evaluation of Joint Flood Prevention and Drainage Benefits in Flatland Watersheds."

The rate of runoff provided by the design criterion $Q = 40 M^{5/6}$ was used as the basic design of all channel improvements. This design capacity will provide for the removal of 1.50 inches of runoff in 24 hours from one square mile drainage area. A channel designed for this capacity will reduce existing floodwater damage to crop and pastures by 60 percent.

Fish and Wildlife

Field investigations were conducted by the Soil Conservation Service biologist and by representatives of the U. S. Fish and Wildlife Service and Mississippi Game and Fish Commission. All channels to be modified were observed in the field and the type of modification was discussed. Damage to existing channel bank vegetation would be the greatest wildlife habitat loss and would cause some environmental degradation.

Recommendations of the Fish and Wildlife Service in regard to channel work within the watershed are as follows: (1) Natural lakes should be bypassed by channel work. (2) Water levels should be maintained in wetland areas with appropriate water level control devices. (3) All approved channel work to be done from the side least damaging to natural habitat. (4) Trees and/or riparian vegetation should be replaced by revegetating the channel rights-of-way with one and one-half acres of trees and shrubs valuable to wildlife for every acre of trees destroyed. (5) Large trees, especially those with hollows, should be bypassed and left for wildlife habitat. (6) Revegetated rights-of-way should be protected from disturbance or destruction for the life of the project. (7) The rights-of-way revegetation plan should be made an integral part of the work plan.

Archaeological and Historical

There are no recorded archaeological or historical sites within the boundaries of the watershed. The Mississippi Department of Archives and History was consulted as to known resources in the project area. The Federal Register - National Register of Historic Places was consulted with negative results. The Mississippi Department of Archives and History has completed an archaeological survey in the project area.

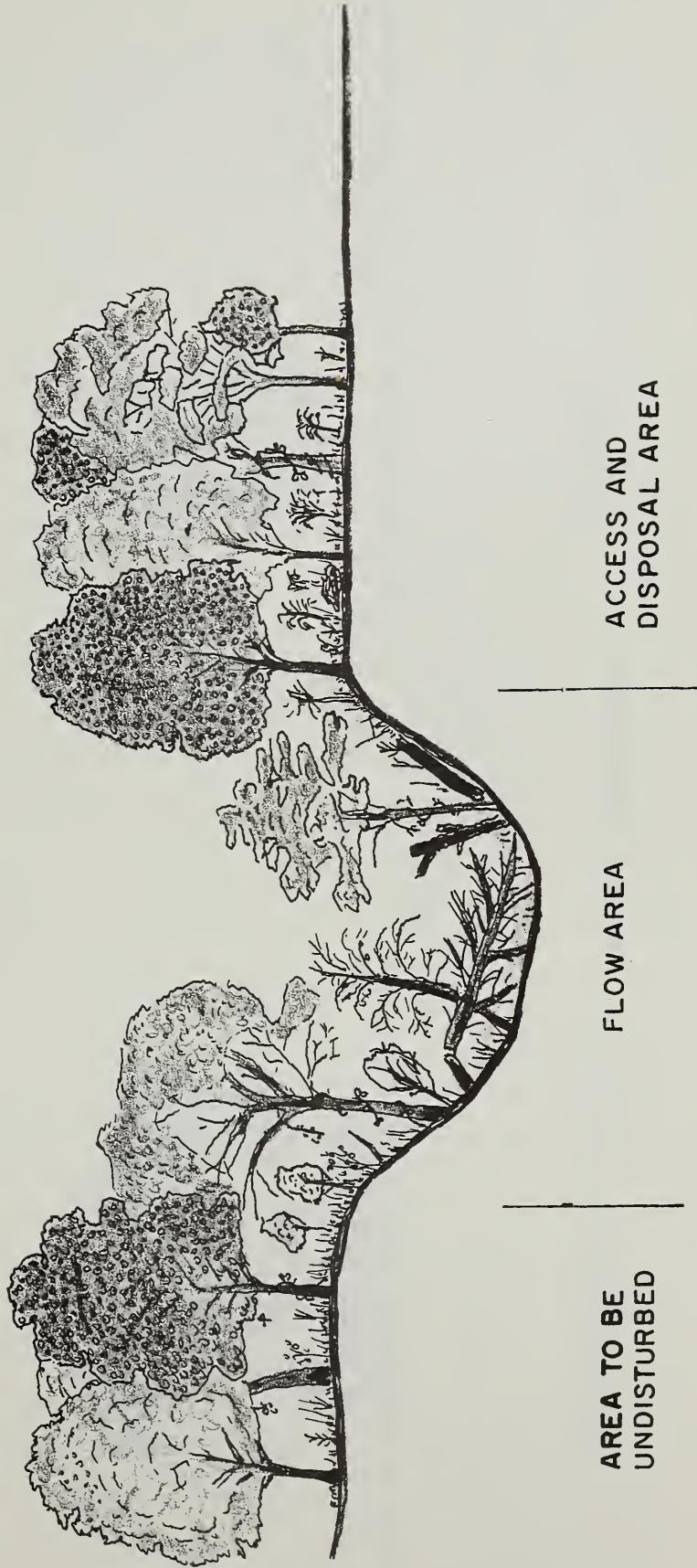
Sixteen archaeological or historical sites have been located in the watershed vicinity. There was one site where possible damage could have resulted from the construction of the project. However, specific construction procedures have been included in the plan at the recommendation of the Mississippi Department of Archives and History which will eliminate the possibility of damage.

According to the State Historic Preservation Officer, as of December 15, 1975, there were no sites in that watershed listed in the National Register of Historic Places or the most recent monthly supplement.

The National Register criteria was used on all recorded sites in evaluating and determining the eligibility of properties for listing in the National Register of Historic Places.

CLEAR FLOW AREA OF LOGS,
TREES, BRUSH AND SILT BARS.

CLEAR ONLY AREA NECESSARY
FOR ACCESS AND DISPOSAL.

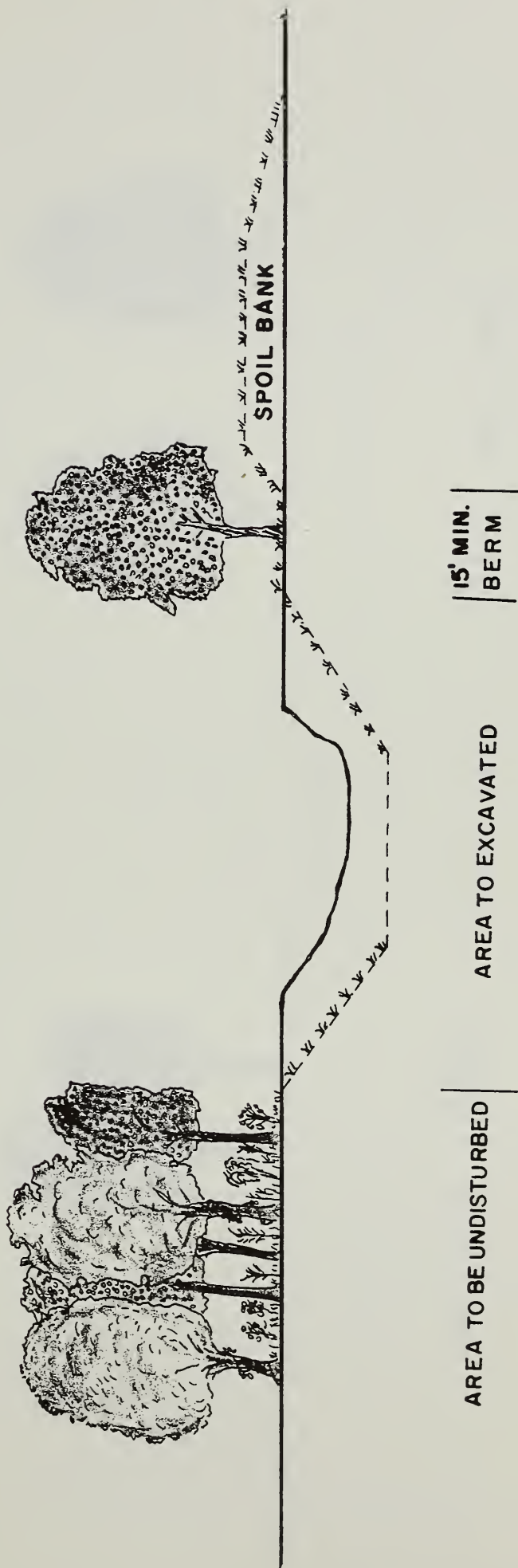


TYPICAL SECTION
CHANNEL CLEARING

FIGURE 1

VEGETATE SPOIL, BERM AND CHANNEL SIDE SLOPES TO ADAPTED VEGETATION.

LEAVE LARGE TREES ON BERM AND IN SPOIL BANK WHERE FEASIBLE.

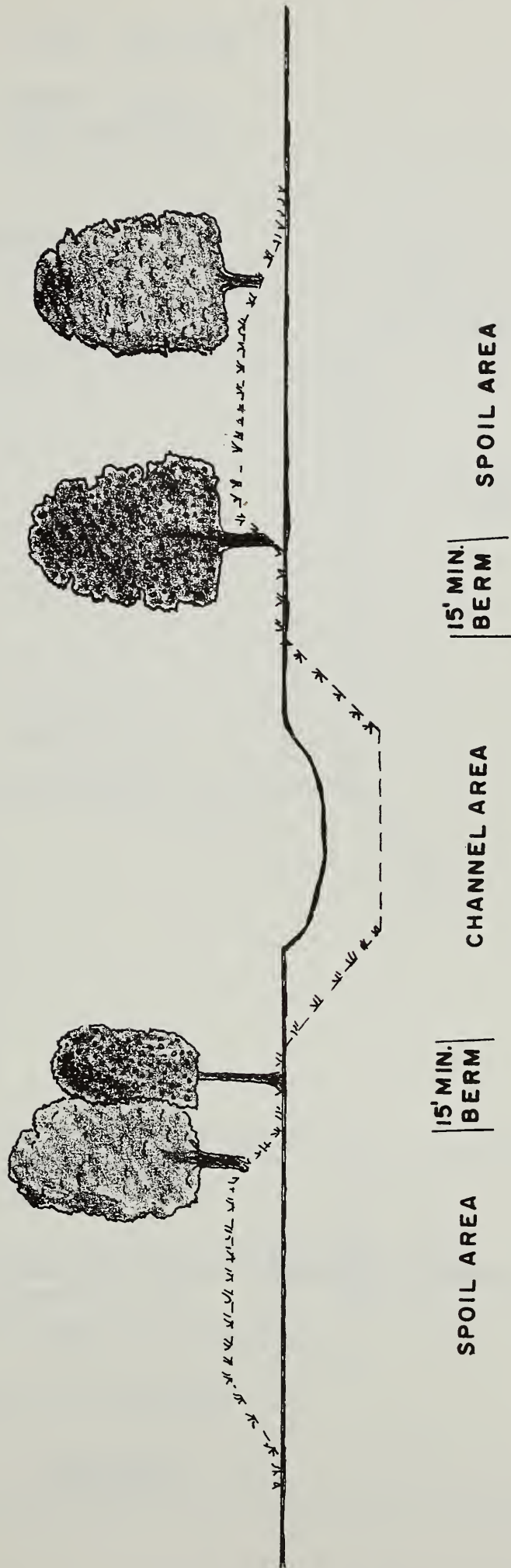


TYPICAL SECTION
CHANNEL ENLARGEMENT
WITH CHANNEL CONSTRUCTION FROM
ONE SIDE.

FIGURE 2

VEGETATE SPOIL, BERMS AND CHANNEL SIDE SLOPES TO ADAPTED VEGETATION.

LEAVE LARGE TREES ON BERM AND IN SPOIL BANK WHERE FEASIBLE.

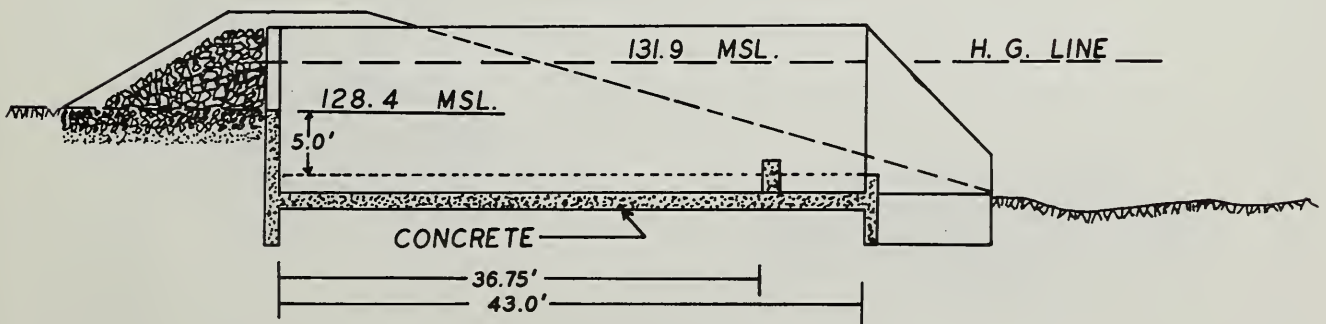
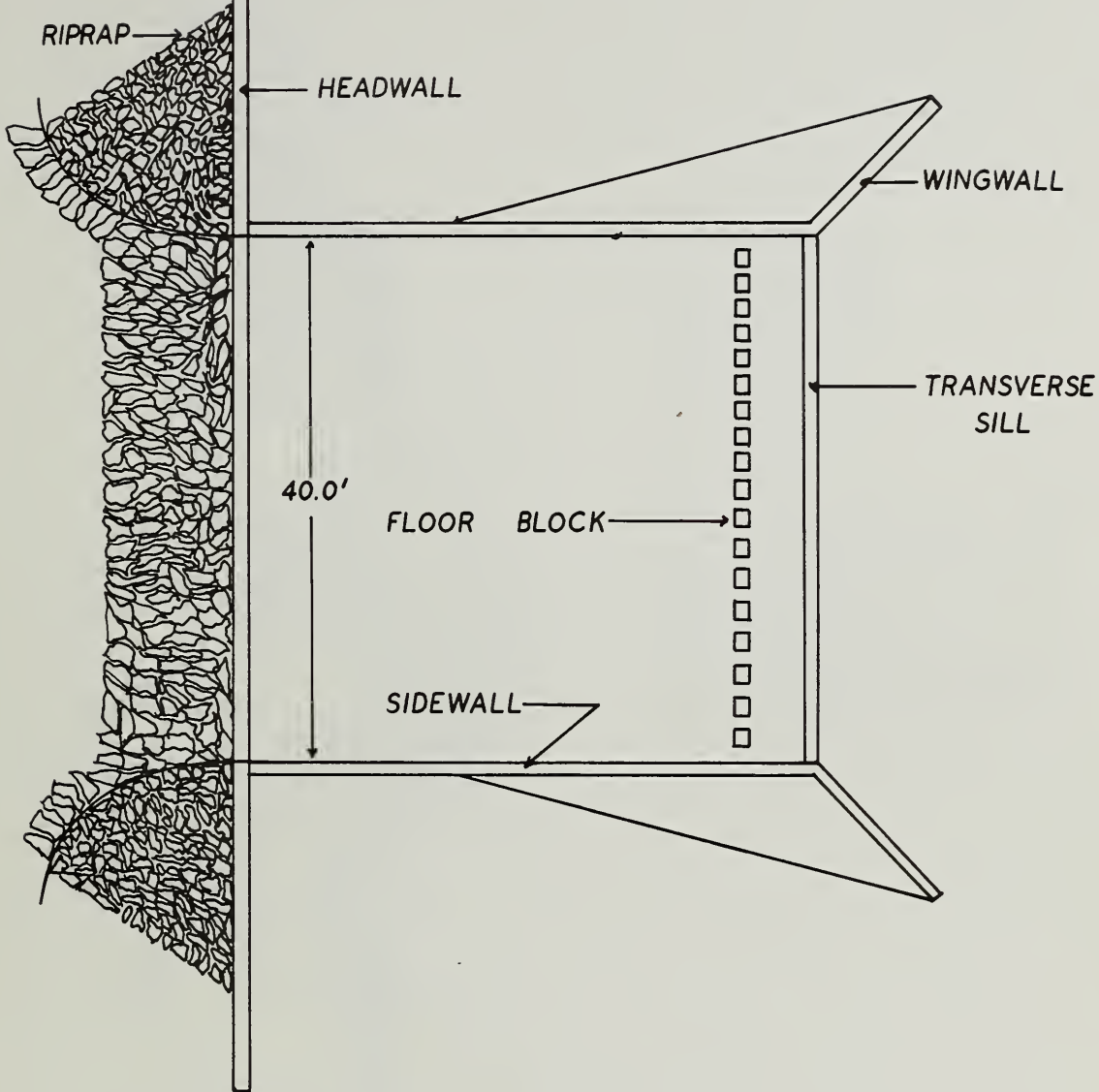


TYPICAL SECTION
CHANNEL ENLARGEMENT
WITH CONSTRUCTION FROM BOTH SIDES

FIGURE 3

DROP SPILLWAY

STATION 50+00
MAIN DEER CREEK



SECTION ON CENTERLINE

FIGURE 4



- LEGEND**
- State Highway
 - Paved Road
 - Secondary Road
 - County Line
 - City Limits
 - Towns
 - Railroad
 - Drainage
 - Levee
 - Watershed Boundary
 - Drainage District Boundary
 - Pipeline
 - Channel Enlargement
 - Channel Clearing
 - Sixteenth Section
 - Flooding and Drainage Problems
 - Flooding Problem

**PROJECT MAP
DEER CREEK WATERSHED
BOLIVAR AND WASHINGTON COUNTIES
MISSISSIPPI**

Approximate Scale

Transverse Mercator Projection compiled at 1:63,360 (1 inch equals 1 mile) and reproduced at 1:94,600 (1 inch equals 1.5 miles).

Base compiled from uncontrolled mosaic 4-R-29595, USGS Quadrangles and General Highway Maps.

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